THE

ELECTRICAL REVIEW.

VOL. LXVI. MARCH 11, 1910. No. 1,685.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: March 11, 1910. [No. 1,685.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEKRAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE PRICE OF RUBBER.

ONE of the most important questions of the present day to the manufacturers and users of insulating materials of which rubber is the base, is whether the rise in the price of raw rubber, which has been steadily going on for a good many months, is likely to be maintained or not; and, although we recognise that it is very dangerous to prophesy, more especially when the forecast is not likely to be a pleasing one, yet we believe our readers will appreciate a statement of the reasons which lead us to the conclusion that no permanent return to the average prices of two or three years ago is to be expected for some long time.

The extremely rapid expansion of the tire trade, although not the only cause, is probably the chief reason of the rise in prices, as the demand for rubber for the manufacture of tires has grown much too quickly in the last year or two for the natural increase in the supplies of wild rubber to keep pace with it; whilst the plantations, to which we are looking for future supplies, have not yet been started long enough for their output to have any very appreciable effect. We appear, indeed, to have reached a stage in which the supply can only keep pace with the demand, owing to the natural check placed on the latter, in cases when other material is available, by the increased price of the raw rubber, and also to the possibility of collecting and placing on the market certain inferior qualities of rubber, which it would not pay to collect if the price of Para rubber was not so high as it now is.

The annual consumption of rubber may now be placed at about 80,000 tons, of which about half comes from the Valley of the Amazon; and, judging from past experience, we must expect an annual increase in the demand of about 5 per cent. How is this demand to be met? As already stated, the output of the Amazon Valley is now about 40,000 tons per annum; but this output has increased but slowly in the last year or two, and there is good reason for believing that it will not be possible to increase it to any large extent, owing to the limited amount of labour that is available, and to the fact that any increase in the output means collecting over a wider area, with a consequent increase in the cost of collection and transport to the mouth of the river. Already the cost of the rubber delivered at the river mouth is over 3s. per pound, to which must be added the cost of shipment to England, and the cost of selling and dealers' profits, before the rubber reaches the manufacturer; so that the prospect of a permanent price of about 4s. per pound is very remote until the time arrives when the production of plantation rubber will have increased to such an extent as to make us independent of the wild rubber supply.

We are not, however, at present looking quite so far ahead as the time when plantation rubber will supply all our wants, but are rather concerned with the probable cost of rubber during the next four of five years. A writer in the *Time*

a few days ago, published some tables of the estimated production of plantation rubber up to, and including, the year 1914, and arrived at the conclusion that the output would, in that year, be about 21,000 tons. As the output for 1909 amounted to about 4,000 tons, this gives an increase of 17,000 tons for 1914, and this is not enough to keep pace with an annual increase of 5 per cent. in the demand. If these estimates are correct, and they appear to us to be very fair, they show that there will be no reason for a reduction in price due to supply overtaking demand; but, as it is difficult to be certain of estimates in a comparatively new undertaking, and as the yield of rubber per acre of plantation has in many instances proved larger than was estimated three or four years ago, we may well consider the probable result of a much larger output of plantation rubber than that named above.

In addition to the output of Brazilian rubber, there was a supply of over 30,000 tons of wild rubber of various qualities from other parts of the world, and the bulk of this rubber is so inferior to Para that its market price is always very much lower. With the present high price of Para it is possible to collect and put on the market raw rubber of which the value to the manufacturer is considerably less than half that of Para, but should the price of the latter fall considerably owing to the increased production of plantation rubber, much of the inferior rubber will cease to fetch a price which will pay for collection and transport, and the increase in the total supply will, to this extent, be checked. This contraction in the supply of the inferior rubbers will be helped also by the fact that the methods of collection in many cases entail the destruction of the plant, so that the districts now being worked will be exhausted, and collectors will have, at any rate, to go further afield, which will increase the cost; whilst, in some cases, there will be no longer any rubber to collect.

To sum up the situation, we consider that the supplies from the Amazon Valley are not likely to increase appreciably, and that the quantity of wild rubber from other parts of the world will probably decrease with any large fall in prices; whilst, for four or five years, the production of plantation rubber will not do more than make up for the natural increase in the demand; so that manufacturers and users must be prepared for some years to face the situation created by the price of rubber being maintained at a figure not much below the average price of the last six months.

The Electrical Industry.

In another part of this issue we publish a further missive emanating from Kingsway offices regarding the electrical industry. Certain gentlemen have been led to constitute themselves into a provisional committee "to take such steps as may be found advisable in furtherance of the legislative industrial and commercial interests of electrical industries." Exactly what are the legislative industrial interests of the electrical industries we cannot say; perhaps the tautology is due to the desire to be altogether-all-the-time *industrial*. The reader will remember the several stages through which this effort has passed. First, it was to take the form of a Union of Electrical Interests; it subsequently developed into an Electrical League under auspices which aroused considerable criticism; the next step was the correspondence between Mr. Garcke and the Council of the Institution of Electrical Engineers which has appeared in our pages recently. Obviously, the reply of the Council did not satisfy Mr. Garcke, and the present communication is only what was to be expected to follow. Anything that this latest provisional committee may be able to do toward the amelioration of the lot of those interested in British electrical industry, and to improve the position of electrical investments, will, of course, be generally welcomed. We learn that "every effort will be made to work in co-operation with all existing electrical societies," and on this point the most elementary thought is that in order to be able so to co-operate, any new organisation must be so constituted as to inspire the fullest confidence. An examination of the pamphlet on "The Need for Co-operation in the Electrical Industry," issued by the same secretary in December, 1908, reveals several alterations in the *personnel* of this provisional committee. Five names have disappeared—Messrs. B. M. Drake, G. Marsden Gibson, M. B. Mountain, Mark Robinson and G. Sutton—but new names have been added, as follows: Messrs. A. Bruce Anderson, J. Cecil Bull, A. Dickinson, H. Justus Eck, J. Barber Glenn, J. G. Lorrain, J. A. Lycett, W. C. Mountain, R. K. Morcom and A. P. Wood. Those who are interested in the movement are asked to communicate with any member of the committee or with the secretary. We presume that the closing sentence of the announcement foreshadows a new and revised edition of the Co-operative pamphlet alluded to above.

Improving Electrical Exports.

The awakening of industry as revealed in exportation continues without hindrance. The official figures relating to our foreign trade are most encouraging, and if the present rate of increase be maintained for a reasonable period we are nationally in for a period of prosperity. The General Election—which may have been a disturbing factor for some home businesses—did not prejudice the exporting results of January. General export trade was 20 per cent. better, and the electrical exports were £28,767 in excess of those for the corresponding month of 1909. For February we have, according to the official returns published in the daily Press this week, a far better result electrically. The electrical goods and apparatus, other than machinery and telegraph and telephone wire, improved from £136,533 (February, 1909) to £197,762 (February, 1910), an advance of £61,229. Iron and steel manufactures improved by £377,487, and other metals and manufactures by £87,749, but machinery showed a fall of £160,930. The great increase in exports of cottons and woollens should help to lift the cloud that has hung over the districts interested in these industries, and has, in the nature of things, had a more or less depressing influence on some engineering and electrical businesses. Taking the results for the two complete months, there has been an improvement of £89,996 in electrical exports. The electrical imports for January decreased by £11,437, but in February they increased by £10,239, as compared with 1909, a net decrease for the two months of £1,198.

Mr. Sutton of Henley's.

To fan the dying embers of a business into flame, or putting it another way, to raise a Success Phœnix-like out of the Ashes of Failure, compels the admiration of all. No matter how little of the commercial spirit may be ours we are ready to heartily applaud the man who can take the helm and steer a business craft clear of rocks on to which it has been steaming full speed ahead, into safe and prosperous seas. Such an opportunity does not come to every man for him to show of what stuff he is made, but when the occasion and the right man meet, as they did 30 years ago in the case of Henley's Telegraph Works Co. and George Sutton, the consequences are more than gratifying to all concerned. Little good would be served by raking over the experiences of the early Henley days—sufficient to say that they formed at

once a warning and an opportunity. The latter was taken advantage of to the full by Mr. Sutton, who, entering the service of the company as a young man with the needful commercial acumen, insight and foresight, soon showed his capabilities for piloting the concern through its difficulties. The exercise of these qualities would, of course, have been of less worth, but for the backing of his efforts alike by Mr. Sydney Gedge and the directors, and by a faithful staff, but it says much for Mr. Sutton that he was able to secure co-operative support from all sides at a time when important business was on the verge of development in electrical application. The shareholders of the company have long ungrudgingly expressed their gratitude to their managing director, as year by year for a long period now they have been drawing handsome dividends on the ordinary capital, and these expressions reached their climax on Friday last, when, at the close of the annual meeting, he was presented with his portrait painted by Sir Luke Fildes, and with a service of plate for Mrs. Sutton and himself, purposes for which £1,000 had been voted at a previous meeting. The speech that was delivered by Mr. Sutton just before the presentation ceremony is extremely interesting, and is as good a testimony to his business ability as one could wish for. He informed his hearers that the best feature of last year was the development and extension of the foreign and colonial trade of the company. Henley's goods had found their way, and were finding their way, into all parts of the Eastern and Western Hemispheres. His comments on the different foreign markets, especially those about the Canadian fly in the ointment, show that the concern of which he is the active head, and in which for 25 years he has had the complete co-operation of Mr. Hatton, of the North Woolwich Works, is as much alive and alert as ever it was. Mr. Sutton is young as ever, in spite of his well-mellowed experience. We have no fear for Henley's while it is run on such lines as have been followed in the last decade or two.

X-ray Victim.

All whose natures contain the least trace of human sympathy, and especially those who have followed with medical or electrical interest the research and utilisation of Röntgen rays since their discovery in 1895, will desire to congratulate, and to express their gratitude to, Sir William Treloar upon the successful outcome of his efforts on behalf of Mr. Harry Cox, one of the earliest workers in connection with X-ray apparatus. Sir William, with his characteristic concern for a variety of charitable objects, took up the present sufferer's case with a view to raising a substantial sum of money to provide for the personal needs of the "victim to science," and, to some extent, relieving his mind by assuring him of a certain provision for his wife and sons until the latter are placed "on their feet." The total amount aimed at—£2,500—had on Monday last been exceeded, some £2,538 having been received, according to the *Daily Telegraph*, to which the fund owes a good deal of its success. A first payment of £100 on account has already been made to Mrs. Cox, and a meeting to discuss the investment of the fund was called for Monday. Now that the immediate financial needs of the case have been met, nothing remains but for us to hope that the sufferer's pain may be eased, and that amidst all his personal distress he may find some degree of solace in the fact that the public were willing generously to acknowledge their indebtedness to one who sacrificed himself in a new practical application of science which had as its very *raison d'être* the mitigation of the sufferings of others.

Overhead Wires.

The paper by Mr. W. B. Woodhouse, engineer and manager of the Yorkshire Power Co., which we abstract at considerable length elsewhere, will be found full of practical and, in many cases, original information on the design and construction of overhead conductors. Owing to the restrictions which, unfortunately, are placed upon the use of these in this over-civilised country by a Government which is supposed to follow public opinion, and certainly is in no danger of leading it, the amount of our knowledge and experience in connection with this subject is somewhat meagre, and therefore we are all the more indebted to the author for placing his hard-won information fully and freely at the disposal of the public. It seems like a touch of irony that one of the most important papers on this subject, and the only one referred to by Mr. Woodhouse, was the work of the electrical adviser to the Board of Trade; but this, as though to provide an antidote against undue exhilaration of the electrical industry, was effectively interred in the *Proceedings* of the Institution of Civil Engineers, thus fittingly restricting its usefulness.

Mr. Woodhouse's remarks are not confined to long transmission lines; in many respects they apply also to overhead distributing systems, which he says—as we have often said—offer the only possible means of extending the benefits of electricity to small towns and villages. If this was true before the days of the metallic-filament lamp, it is doubly true now; if, therefore, the authorities maintain their present attitude, they practically prohibit the supply of electricity in such places. This is not a matter of public safety—to put it on that basis would be sheer nonsense, when heavy bare overhead conductors charged at 500 volts are suspended, usually by nothing more reliable than solder, over our most populous thoroughfares. The Board of Trade has no right to concern itself with questions of æsthetics; the public can be trusted to take care of them, and anyhow, if trolley wires, and, worse still, guard wires, are allowed, there can be no objection on that score to electricity supply conductors. We do not want a grudging permission on the merits of each individual case—we want the complete release of all townships with a population of less, say, than 10,000 inhabitants, from the illogical and oppressive restrictions under which they suffer, subject only to reasonable—*reasonable*—conditions as to the methods employed. Is this a free country or not?

Responsibility for Bad Debts.

A correspondent has recently inquired whether and how far a "traveller" is responsible for the solvency of those whose orders he sends on to his principals. The question is of considerable importance. The firm in London or in any other great centre knows but little of the financial reputation of those to whom it sends off goods, and it is only when the time of payment arrives that the naked truth stands revealed. But where does the traveller, or "man on the road," come in? Probably he has been "taken in" himself, and it is certainly good law that he cannot be held responsible for the loss incurred by his principals, unless he has undertaken in writing to answer for the debt, default or miscarriage, of the customer whom he recommends. In any event, the principal would not feel inclined to deal severely with a good traveller who occasionally made a mistake. Moreover, he can take certain precautions, which should reduce the risk of making bad debts to a minimum. In the first place, before sending away any goods to a new customer, he can avail himself of a private inquiry agency. He can, by this means, ascertain whether the customer has been in the habit of paying up, or whether he prefers to let himself be sued in the county court. If the information which he thus obtains is unsatisfactory, he can (if competition will allow him) refuse to send any goods, except for payment in advance. So far as the "traveller" is concerned, it is probable that if he is paid by commission, not on the amount of his bookings, but by way of a percentage on the sums actually received by the principal, his faculty of judging the solvency of those with whom he deals will be considerably stimulated.

PROGRESS AT MANCHESTER ELECTRICITY WORKS.

Since the autumn of last year a number of large and valuable power consumers have been secured by the Manchester Corporation Electricity Department—indeed, the total booked in this short period will amount to 5,000 H.P. installed. This, both in regard to the volume—some 7 or 8 million units per annum are expected to be required—and in regard to the nature of the customers' business, is very satisfactory indeed. We are enabled to mention here some of the principal new consumers whose demand is included in this 5,000 H.P. :—

Messrs. Galloways, who are devoting very close attention to big gas-engine work at their Knott Mill Engine Works, are to take for that establishment, and for their boiler works at Ardwick, some 400 H.P.

Messrs. Richard Johnson & Nephew, whose works are now partially electrically operated, are taking an additional 1,000 H.P., to be used entirely for their steel wire-drawing plant.

The Great Central Railway are taking 250 H.P. for their locomotive works at Gorton. This is the first instalment of the Great Central demand from the Manchester Corporation supply. To begin with, they are putting down a D.C. sub-station.

We were interested to learn from Mr. Pearce recently that the Manchester Electrical Exhibition of about eighteen months ago had a decided influence upon his undertaking. The department last year had the biggest increase in the volume of lighting business that it had ever experienced, and this was largely due to the educative effects of the exhibition, as was also the on-coming of a good deal of the small-power demand.

We understand that the large Tudor battery installation will be in working order shortly; the large motor-converter installation is working very satisfactorily, and it is expected that it will therefore be possible to shut down Dickinson Street station generating plant for six months this year.

It will be recollected that in September last the second large turbine set was started up at the Stuart Street station; this is a Zoelly type turbine, constructed by Messrs. Jas. Howden & Co., Ltd., of Glasgow, and coupled to a Siemens alternator of similar construction to that which forms part of the adjoining set, which we described and illustrated in our issue of May 15th, 1908.

The turbine operates on the now well-known multi-stage principle, in which the expansion of the steam takes place entirely in the guide blades of the stationary diaphragms, its velocity component being absorbed in the vanes of the running wheels which rotate between the fixed diaphragms.

The features of this construction were detailed in the Electrical Review of September 2nd, 1904; it leads to

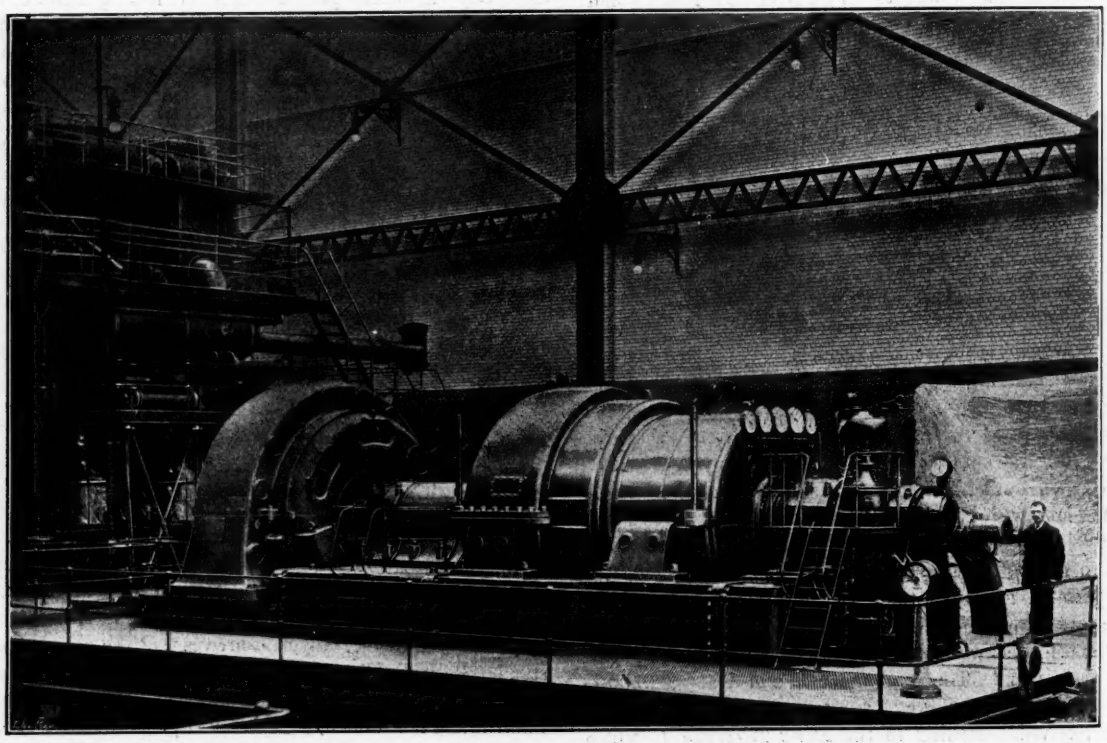


Fig. 1.—6,000-kw. Howden-Siemens Turbo-Alternator at Stuart Street Station, Manchester.

At McConnell's Mill some 400 H.P. will be used for operating part of this Fine Spinners mill.

At Byrom's Mill, which will be an example of complete electrification, and will be ready in the course of a few weeks, some 800 H.P. will be required.

The London and North-Western Railway Co. are arranging to take a supply for the whole of their power and lighting requirements at London Road Station.

The Calico Printers, at their Levenshulme print works, which have just been started, have made a beginning with some 400 H.P.

Messrs. Hans Renold are taking an additional 100 H.P. for their fine new works at Burnage.

The Manchester Dyers at their works started in December last are taking 200 H.P.

By Messrs. Marchingtons, of Droylsden, some 200 H.P. is to be taken.

reduced end thrust and the possibility of using large clearances.

The speed of the set is controlled by a centrifugal governor actuating the throttle valve through the intermediary of an auxiliary oil system—the oil being supplied at 80 lb. pressure by a valveless pump.

The turbine exhausts direct into a Richardsons-Westgarth Contraflo condenser situated below, as shown in fig. 2. The condensing plant comprises also a three-throw Edwards air pump, driven by a 55-H.P. slip-ring motor; a De Laval circulating pump, coupled to a 375-H.P. squirrel-cage motor; and for dealing with the hot-well water, a vertical spindle De Laval pump driven by a 16-H.P. motor.

The Siemens alternator is a three-phase six-pole machine, generating at 6,500 volts and 50 cycles; as in the case of the adjacent machine, it is provided with forced ventilation; the air is drawn in from outside, and after being filtered

and passed through the rotor and stator, is again returned through a duct outside.

While the normal output of the combination at 1,000 R.P.M. is 6,000 KW., it is capable of generating up to 9,000 KW. in emergency.

As the result of various tests, the following figures were obtained :—

Load.	Duration of test.	Water per KW.-hour.	ean efficiency.
7,500 KW.	3 hours	14·1 lb.	7 %
6,000 KW.	6 hours	13·8 lb.	71·5 %
4,500 KW.	3 hours	14·4 lb.	69·4 %
3,000 KW.	3 hours	15·7 lb.	67·6 %
1,500 KW.	3 hours	16·7 lb.	64·5 %

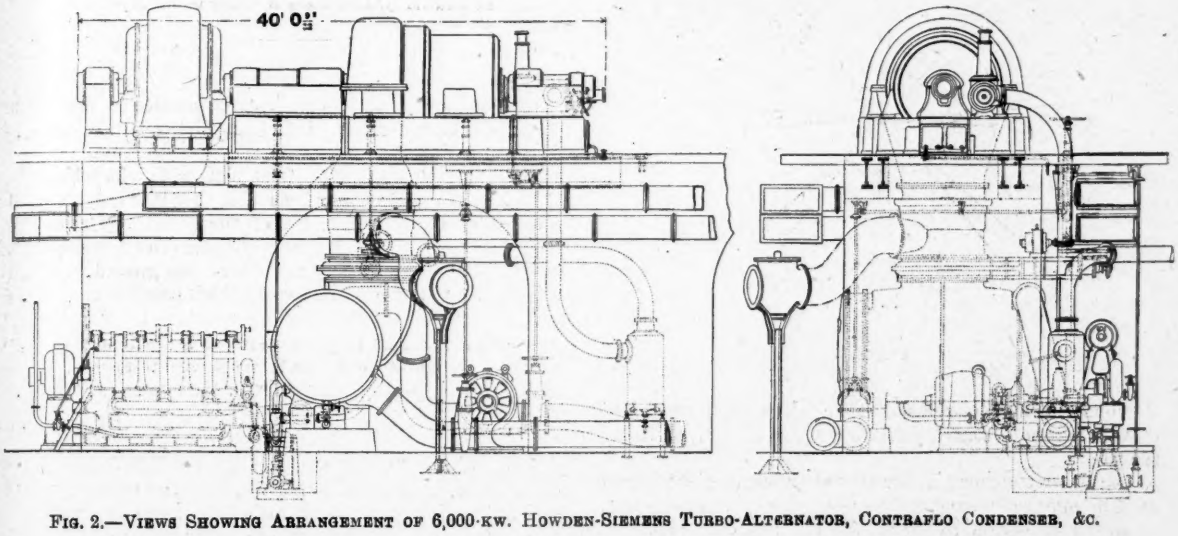


FIG. 2.—VIEWS SHOWING ARRANGEMENT OF 6,000-KW. HOWDEN-SIEMENS TURBO-ALTERNATOR, CONTRAFLO CONDENSER, &c.

An open-circuit trial of three-quarters of an hour duration, with full excitation, gave the following results :—

TURBINE.

1.	Mean steam pressure at stop valve	186 lb.
2.	„ „ temperature	494° F.
3.	„ „ pressure at steam chest ...	4 lb
4.	„ superheat	115° F.
5.	„ temperature at exhaust	113° F.
6.	„ vacuum	26·65 in. Hg.
7.	„ barometer	29·55 „
8.	„ vacuum, corrected to 30 in. barometer...	27·1 „

ALTERNATOR.

9.	Mean voltage	6,500 volts
10.	„ field current	82 amps.

KW. USED ON AUXILIARIES.

11.	Condenser pumps	320 KW.
12.	Alternator—fan motor	18·1 „
13.	„ —field excitation	17·2 „
14.	Total	353·3 „
15.	Total weight of water registered on "Lea" recorder (condensate + spray water)	19,608 lb.
16.	Total weight of water per hour ...	26,144 „
17.	Spray water per hour—from water meter ...	20,666 „
18.	„ „ „ —less 1 % correction ...	206 „
19.	„ „ „ —difference	20,460 „
20.	Water from hotwell per hour (No. 16 less 19)	5,684 „

We are indebted to Messrs. Howden for our illustrations of the plant.

Brunswick Mill Installation.—In connection with our illustrated article on the electrical equipment of the above mill, which appeared in our last issue, we are informed that the contract for the work was placed with the Manchester Corporation, who sublet it to the British Thomson-Houston Co.; also, that after placing the contract, the Bannerman Mills Co. retained Messrs. Lacey, Sillar & Leigh to advise on and supervise the carrying out of the scheme, which was ultimately revised and carried out to the requirements of the consulting engineers.

Electric Shock Fatality.—A workman in the employment of the Clyde Valley Electrical Power Co., Ltd., Glasgow, while at work in the switch house at Halfway, Cambuslang, accidentally came in contact with a live switch, and was killed instantly.

PROTECTIVE NETS FOR ARC LAMP GLOBES.

BY S. LEES.

IT is a strange and surprising fact that many otherwise skilled arc-lamp attendants do not know how to weave protective nets for arc lamp globes. This should not be so, as, in the Board of Trade regulations relating to the protection of the public, it is provided that all arc lamps shall be so guarded as to prevent pieces of ignited carbon, or broken glass, falling from them. Yet, at the present day when the enclosed type of lamp is so popular, it is the exception rather than the rule to come across an efficiently netted globe. With the older open type of lamp, nets were invariably used, but in the case of the enclosed type, above mentioned, a protective net would seem to be considered unnecessary judging by the large number of unprotected globes in use. And yet, considering the curious phenomena which are peculiar to enclosed lamps, and the additional work imposed on many globes of this type other than that of their primary function, it would seem to be of the greatest importance that some protective device in the form of a net should always be provided.

FIG. 1.

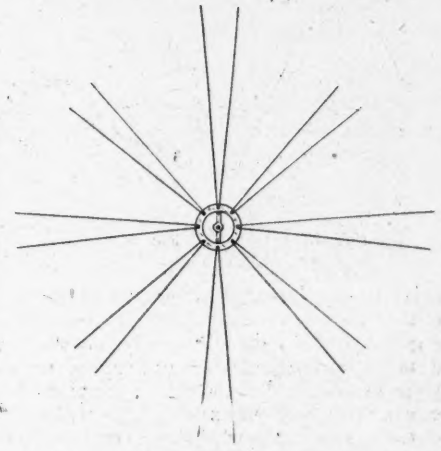


FIG. 2.

The weaving of a wire net or cage for the purpose mentioned is not a very difficult job, though there may be something of mystery surrounding it as in the case of rope splicing. But once get the hang of the thing, and the supposed mystery disappears.

With a view of rendering assistance to the uninitiated, the writer will endeavour in the following to explain the operation of making an efficient wire protective net.

The tools required are of the simplest description—namely, a pair of cutting pliers, and what is known to the fraternity as a "pegging board." The latter is a piece of straight deal board measuring over all about 4 ft. × 1 ft. × 1 in. thick. This is provided with a few steel pegs or pins, the use of which will be explained fully later. For the net, the material required will be a reel or bobbin of No. 18 S.W.G. tinned copper wire.

For the purpose of illustration, the writer will take an example of a 15-in. spherical globe. Eight 6-ft. lengths of

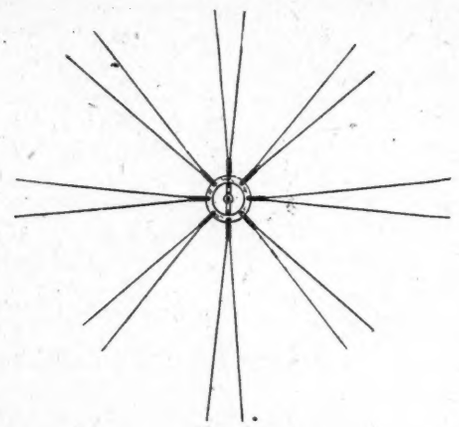


Fig. 3.

the copper wire are cut off, and stretched, care being exercised that the latter operation is performed without unduly straining the wire.

The bottom anchor plate or ring of the lamp globe is now fixed by means of a stout wood screw A to the pegging board, as shown in sketch of board, fig. 1. The cut lengths of wire are doubled, and then threaded through the several holes until all are filled up as illustrated in fig. 2. Each pair of wires thus formed is given a twist of about half a dozen turns, as shown in fig. 3. One strand from each of a pair of *adjacent* wires is now selected, placed against peg B, as in fig. 4, and given a twist of half a dozen turns. Each pair of

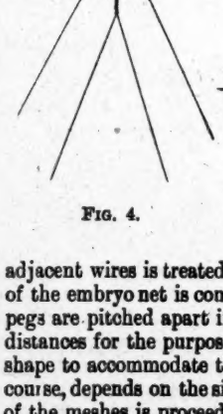


Fig. 4.

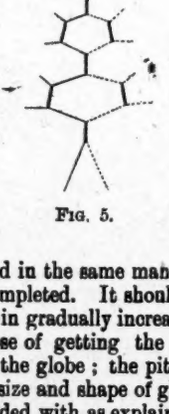


Fig. 5.

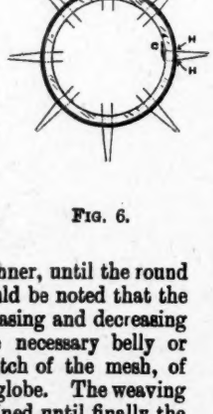


Fig. 6.

adjacent wires is treated in the same manner, until the round of the embryo net is completed. It should be noted that the pegs are pitched apart in gradually increasing and decreasing distances for the purpose of getting the necessary belly or shape to accommodate the globe; the pitch of the mesh, of course, depends on the size and shape of globe. The weaving of the meshes is proceeded with as explained until finally the net will assume (a section only is given, flattened, for clearness) the appearance shown in fig. 5. To further facilitate tracing the operation, one wire in each section is shown dotted in the figure last mentioned.

The net is now ready for fitting. The globe should be inserted carefully, and the tail ends of the wire sections strained out firmly but with care, so as to ensure a good fit all round the globe. The top ring is now fitted; the two tail ends from each pair of wires, after being threaded correctly through their respective holes, marked H, are given the usual half a dozen turns and then bent over, as shown at C in fig. 6.

An example of a 15-in. globe has been chosen as being fairly representative of a type of public street lamp. Smaller nets are simpler to make, and, of course, the different forms of anchor rings, &c., will have to be treated as individual circumstances require, but the writer hopes the foregoing will prove sufficiently clear to enable the operation of weaving an arc-lamp globe protective net to be performed successfully, at least after a little practice, by the average arc-lamp attendant.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Earth Plates.

In construction work it is common practice to bury earth plates in coke, the reason given being that a better earth is thus obtained.

If one considers the area of the plate with which the coke is actually making contact, one sees that it is quite a small percentage of the total area of the plate, owing to the uneven shape of pieces of coke. It seems to the writer that if the plates were buried directly in the ground, a much better contact would be obtained, which would outweigh the advantages gained by the higher conductivity of the coke. The writer would be very interested to know if any of your readers have carried out actual resistance tests with plates thus buried, and what the results of the two methods were.

Resistance.

[The coke is employed as an intermediary between the earth plate, of high conductivity, and the moist earth of low conductivity, and is of little use unless it presents a large surface of contact to the surrounding earth. The permanent presence of moisture is the essential condition for a good earth to be obtained. The subject of earthing is of great and increasing importance, and is one on which very few reliable data are obtainable.—EDS. E.R.]

Gas Leakage and Electric Mains.

I should be much obliged if you would express your opinion, and also if other engineers similarly situated would express their opinions, as to the best proceeding to follow under the following conditions:—

A corporation electricity department and the gas department are under the control of an ordinary Borough Council Committee. The gas department was acquired from a company, but the electricity department was inaugurated by the Council. The cables are laid on the draw-in system, and the gas mains are in an extremely bad condition, allowing a large quantity of gas to escape and find its way into all the conduits and box chambers.

A number of explosions have happened, but fortunately only a little damage has been done. To suggest ventilation is out of the question. In a recent instance two box chambers were opened (the ends of all conduits in each direction are always kept puddled up with clay), and a jointer had been at work in one for five hours, when he was overcome by gas which was finding its way into the box, and it was a considerable time before he fully recovered.

In another instance, where the conduits passed close to the gasworks, a jointer had been at work one day (previously to the conduit ends being puddled up), and a quantity of gas ignited and continued to burn back in the conduit for some distance—the gas was finding its way into the conduit at a point where a service had been put on—and it was necessary to run out a fire hose and flood the conduit with water before the flame could be extinguished.

Reports have frequently been made to the Committee as to the bad state of affairs, but nothing is done; letters used to be sent to the gas department every time a box chamber was opened, or a service was put on, but the whole system is now reeking with gas (so badly that if the ends of the conduits are uncovered, the gas finds its way into the generating station), and it is looked upon as useless to waste time in writing any further letters.

The Board of Trade Regulations state that, if gas is found in any of the chambers or conduits, notice shall be immediately given to the gas undertakers; but what is to be done if, after such notice is given, the gas undertakers pay no attention to it? Is the Board of Trade to be notified?

The Committee controlling the two undertakings is the old Gas Committee, which existed many years before the electricity undertaking came into being, and consequently the gas department is its pet concern. A suggestion on my part that the gas department should lay new mains, where necessary, was immediately strongly negatived, and a counter suggestion was made that an expensive form of ventilator should be fixed in the box covers. This I agreed to, providing the gas department paid a reasonable proportion of the cost of such ventilators and their fixing, but the Committee would not agree to that, and we are consequently at a standstill again.

There cannot, of course, be many instances of this sort, but I should be extremely glad to learn what is being, or has been, done in other cases.

Borough Electrical Engineer.

"We Sell Electricity and Publicity Literature."

The above title is put forward with all diffidence by the writer as a suggested motto, or advertising catch phrase, for use by the electricity supply authorities of London and district in conjunction with their new departure in taking up the sale of advertising literature in addition to their normal, or more legitimate, business of selling electricity. With ambition that is possibly commendable, the Joint Publicity Committee have decided to offer to supply printed circulars, leaflets, coloured posters and literature of a descriptive character dealing with the varied applications and uses of electricity, to any or all of the electricity supply undertakings of the United Kingdom that may care to buy, and have duly circularised these undertakings to that effect. In theory, no doubt, the principle of this particular big co-operative scheme is sound, but in practice it is almost a case of the blind leading the blind, for the London undertakings cannot be said to have had much experience in publicity work; in fact, their well-known neglect of this department of their business is almost a by-word among gas companies. Even now, to all appearances, judging from their circular letter, and the samples of their first efforts in the way of advertising matter, they have no concrete, systematic and persistent scheme in view. Every advertiser of experience realises the necessity for continuity of policy in these days of strenuous competition with other advertisers along the lines of a well-planned scheme; this being so, it will be appreciated that any idea of electrical advertising must follow suit, if possible going one better than the ordinary advertiser.

The Joint Committee's ideas appear to be a little crude, for they expect country undertakings to purchase a poster, which has to be doctored up by pasting a slip of paper across it to hide unsuitable wording. The design of the poster itself is not above criticism from the point of view of the purpose to which it is to be applied; its compilers certainly could not be commended for their knowledge of English composition, and the design, consisting as it does, of an electric incandescent lamp covered by a very ordinary looking conical reflector, does not seem to throw much light on the dark and gloomy picture of London spread out beneath—a picture which is not of great assistance to country undertakings. The prices which it is proposed to charge are somewhat high, the 40 in. × 25 in. poster being listed at 50 for 25s., whereas 5s. 6d. is nearer the market value; 30s. is asked for the showcards, which is about three times too much. A circular which was submitted gets nearer a normal price, being only about 25 per cent. too much. Of course, it is a moot point as to whether or not it is permissible for the local London authorities associated with the supply companies to engage in trading of this nature.

As might be expected, no illustrations are incorporated in the circular—a very elementary mistake in advertising.

Unfortunately, country central station engineers receive a good many circular letters, so it is to be feared that the Committee will not receive much response until they adopt the plan of sending a traveller round the country to interview the managers and engineers.

An energetic publicity campaign is badly needed in the London area, and therefore any attempt, however crude it may be, is to be welcomed.

It has evidently been no easy task to get all the companies and local authorities to co-operate in their own interests, so it is to be hoped that they will not split on the adoption of a poor policy and wrong principles.

Central Station Man.

Insane Competition.

Your leading article under the above heading, in your issue of February 25th, concludes with the question, "Why should the electrical industry starve itself?" The writer, apparently aghast at such suicidal tendencies, goes on to exclaim, "It is folly."

If folly be the policy of fools, and the adage be true that experience is the only thing that makes fools wise, then I see little cure other than patience for the insane competition of which you speak. It might, however, assist us to try and determine the principal causes of the present condition of the electrical industry, and, perhaps, they may be found under the following headings:—

1. Over-production, and, as its natural corollary, a desire on the part of those manufacturers who cannot find sufficient work at a fair rate of profit to fill their factories, to obtain orders to keep their chimneys smoking, which, though at such prices as do not pay them, yet make their loss less than it would be if their factories were shut down altogether.

2. Many manufacturing concerns are run by over-capitalised limited companies where officials are more prone, in considering their salaries rather than the shareholders' dividends, to hope against hope that the financial position will soon right itself.

3. The introduction into electrical enterprise of a number of young men who, while possessing the necessary technical qualifications, lack that commercial and financial knowledge and experience, without which it is impossible to run a business on successful lines.

4. The unfortunate readiness of manufacturers (mainly for the reasons stated in our first premise) to finance such men by supplying them with goods on long credit terms.

One of the most important points which the neophyte overlooks, or is ignorant of, is that there must be sufficient margin of gross profit to provide for the many contingencies which are inseparable from electrical manufactures, and the fact that travellers or salesmen in the industry must, in most cases, possess more or less technical knowledge, and necessarily command higher salaries than the ordinary "commercial."

It is perfectly true, as you say, that "well-established and sound contracting firms who are well qualified to carry business through satisfactorily, have to be content—because they will not do bad work or work at a loss—to see good business go past them to new and weak firms." What we have to do is to combat the tendency of manufacturers to encourage these mushroom firms, whose short existence results in no good to themselves and injures the industry at large. It perhaps would astonish you to learn that I can count on my fingers the number of contracting and electric supply companies in existence to-day who were contemporary with my own firm when we started, now nearly 20 years ago. This tells its own tale.

You ask why should the electrical industry starve itself? My answer is simply because there is at present not enough food to feed it, and until we can get many of the firms engaged in the electrical enterprise to realise this fact, this unfortunate state of affairs must continue.

Edward Bergtheil.

London, E.C., *March 1st*, 1910.

Protection and the Electrical Industry.

It is really impossible to be angry with a gentleman whose understanding is of "C. E.'s" calibre. When I wrote you giving particulars of the 100-H.P. motor, I based my opinion on the current price lists of the best makers. I have now such a one in front of me :—100-H.P. motor, 750 R.P.M., weighing 38 cwt., price, net, £130 ; 100-H.P. motor, 575 R.P.M., weighing 45 cwt., price, net, £150.

I am assured by this maker (who, you will admit, stands at the top of the profession) that the motor at 750 revolutions is quite an ordinary machine to sell, that the speed is not abnormal, and that, unless specially ordered, this is the machine that would be supplied. On the other hand, if a more moderate speed machine were desired, the more expensive one, weighing 45 cwt. and costing £150, would be supplied.

The machines of this maker have been designed to comply with the requirements of the Engineering Standards Committee. You will, I am sure, be the first to admit that I have endeavoured to be as fair as possible with "C. E." by conceding him 5 cwt. in the weight and a small amount in the cost, but it is quite evident that it is of no use to endeavour to be fair with an opponent in argument such as "C. E." is.

With the rest of "C. E.'s" remarks I have no concern, except that they show a desire to bury the main issue in a number of side issues. I will only remark, as showing his line of argument, that I have never either stated or insinuated that I paid the duty on my goods entering the United States of America.

I may add for "C. E.'s" information, that my offer of the £5 is still open, with this exception, that I will now increase it to £10, if he so desires ; but I am afraid he is not much of a sportsman, either in his method of argument or otherwise.

Ex-communicated.

"C. E." enters into the controversy firmly convinced that a tariff is necessarily a tax. This is far from being true, and in the case of small duties, as distinct from the prohibitive duties of America and Germany, even eminent Free Traders admit that the consumer does not necessarily pay the whole, or, in many cases, any of the duty.

The last paragraph but one of "C. E.'s" letter admirably sums up the case. Because Germany refuses to import British electrical goods and maintains her home market free from unfair competition, she is able to export goods to to England at a very favourable competitive price, and sell them in this free market of ours to the detriment of our manufacturers. It is an axiom that increased output lessens the individual cost of production, and it seems to me that reserving the home market intact gives an impetus to export trade on account of the lessened cost of production due to an increased output.

I agree with "C. E." that Tariff Reformers and Free Traders alike desire universal free markets. However much we may desire this condition of trading, such a state of affairs is impossible, and whilst waiting for the fulfilment of Cobden's prophecy, it behoves us to maintain our own market free to our own manufacturers, as every other industrial country is doing.

Might I point out to Mr. Low that if the replies of the "economic critics" of Tariff Reform were stripped of their pretty similes of the sun's daily path and the Egyptian rainfall, the said replies would be as brief as the letters expounding Tariff Reform ?

E. F. Rendell.

Wallsend-on-Tyne, *March 7th*, 1910.

May I vary the monotony of controversy with the application of a useful statistical method.

We imported in 1909 £147,700,000 worth of goods classed as wholly or mainly manufactured.

Taking each sub-class of such goods by itself, the selling price may be analysed as follows :—Raw material ; freight ; insurance ; commissions ; manufacturing, capital and establishment charges ; wages paid in manufacturing processes. The ratio—

$$\frac{\text{Wages paid in manufacturing processes}}{\text{Selling price}},$$

may be called the "Manufacturing Wages Factor," or for short, the "Wages Factor."

I append a list of such "Wages Factors," roughly calculated for each important class of imports :—

Imports of manufactured material.	Selling prices.	Wages factor.	Total wages spent in manufacturing processes.
Iron and steel	£8,000,000	·10	£800,000
Other metals	24,300,000	·02	500,000
Cutlery, instruments, &c.	3,700,000	·30	1,100,000
Electrical goods, &c. ...	1,300,000	·30	400,000
Machinery	4,400,000	·25	1,100,000
Wood and timber ...	2,000,000	·10	200,000
Cotton	9,800,000	·10	1,000,000
Wool	9,700,000	·15	1,500,000
Silk	12,800,000	·20	2,500,000
Jute, &c.	7,300,000	·10	700,000
Apparel	5,100,000	·30	1,500,000
Chemicals	10,600,000	·10	1,100,000
Leather	11,600,000	·15	1,700,000
Earthenware and glass ...	3,800,000	·10	400,000
Paper	5,600,000	·10	600,000
Miscellaneous	27,500,000	·20	5,400,000
	£147,500,000	[av. ·14]	£20,500,000

For our exports of wholly or mainly manufactured articles the average wages factor is about ·28, or double the figure for similar imports. This might have been expected from the fact that our manufactured imports are largely raw materials for our finishing processes.

Our shipping services, further, have the same place in international accounts as exports of manufactured goods. The earnings of our shipping amount to about £90,000,000 per annum. Deducting £15,000,000, a liberal allowance for payments to foreign shipping, and taking the wages factor as 0·15, we may compare the "imports of manufacturing wages" with the exports of the same kind :—

	Wages factor.	Total wages.
Exports of manufactures, £378,000,000 ...	·28	£106,000,000
Balance of shipping earnings, £75,000,000	·15	11,000,000
		£117,000,000

It is thus seen that while we imported 20½ million pounds' worth of unemployment (to use the preposterous notation of Tariff Reform), we exported 117 million pounds' worth of the same commodity. In the sane language of economics, the policy of free imports is indeed a highly efficient protection for our home industries.

A. R. Low.

Loughborough, *March 5th*, 1910.

When Mr. Low talks of facing my foil, I cannot help remarking that it is not his face that I seem to see most of during this pleasant little discussion. Why does he run away as soon as he is asked a plain, practical question ? I want to discuss this subject in the market place, and he refuses to leave the laboratory. I don't want to know what goes on inside his test tubes. All that I am interested in is that which prompted me to write in the first place. Seeing that there is such a universal desire to "support home industries," both on the part of corporations and private buyers, when, as you put it, "there is not much advantage" to be gained by purchasing cheaper foreign articles, all I want to discuss is what is the underlying economic explanation of this instinctive preference. My own theory is that people feel that every time they buy anything they employ labour, and they think it better for the community to employ native labour.

There is a communal, as well as an individual, instinct of self-preservation.

But if there is anything at all in the text-book theory of Free Trade, all this is very thin moonshine. That theory insists that when a Corporation, for example, buys £10,000 worth of foreign electrical plant it does not do British labour out of a job, because British labour must produce something else to pay the price of that £10,000 plant.

Nobody believes it ; no Parliamentarian or Councillor will get up before a popular audience and say that it is foolish-

ness to give any preference to British labour when you buy anything. A prominent local Free Trader in the boot trade was very indignant with me the other day because I was wearing a pair of American boots. I did not know it till he told me, and then I tried to expound Free Trade principles to him, but he said I was quibbling. He was talking business, not politics. Mr. Bottomley has unearthed a very instructive example of a Liberal M.P. who, on the political platform, declares that Protection would increase unemployment, but on the wrappers of the articles made by his firm exhorts the public to support home industries and employ British labour. If voluntary Protection is universally approved, why should the Legislation hesitate to give effect to the wishes of the people and make it a little easier to buy British goods in competition with foreign?

Mr. Low's method of dealing with these practical points is to tell me that my definition of Protection is faulty, because the Glasgow Corporation is not a Government, which is news to me. I like my definition all the more, after reading his criticisms, which are easy to make and easier to answer; but which are not worth making or answering. Take that paradoxical conclusion from the application of my definition to the Repeal of the Corn Laws. I saw it coming. I knew that Mr. Low couldn't miss it. It was probably the most violent interference with trade ever known, and its intention was to favour one class of industries, namely, textile and other manufactures, at the expense of another, namely, agriculture. It was the right policy at the time, but circumstances are now quite different.

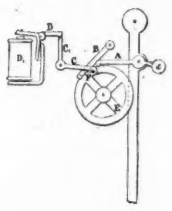
This is my last letter, unless Mr. Low or someone else is willing to talk business. With the House of Commons in the most humiliating position it has occupied for two or three centuries, we are all very much disgusted with politics.

T. C. Elder.

Modern Electric Time Service.

We have noticed your article commencing at page 365, and would point out that the paper contains an error which should be corrected in fairness to ourselves. Fig. 11, on page 367, is labelled "Standard Time Co.'s Synchroniser"; this should be marked "Half-minute control introduced by Gent & Co., Ltd., of Leicester, for their waiting-train turret electric clock movements."

The diagram shown is a sketch drawn by us, and originally printed in the Society of Arts *Journal*, dated



September 17th, 1909, and again reproduced in the *Jeweller and Metalworker*, of November 15th. It will be observed that the diagram includes a form of magnet which is our patented speciality.

We think you should, in our interest, republish this sketch and give its derivation.

Gent & Co., Ltd.,
Hardy Parsons, *Managing Director.*

Leicester, *March 7th*, 1910.

[We regret the error pointed out by our correspondent.—Eds. E.R.]

Use for Obsolete Electricity Meters.

We are glad to see, from page 331 of your last issue, that our (Chamberlain & Hookham) meters, even in their old age, are still able to give good service. There is, however, an objection to your contributor's idea, as a study of the meter indexes is necessary in order to see the difference between the two forms of lighting, and we all know that the reading of the old style of counter is a difficulty with the average householder.

Another objection is that it leaves it open for the sceptic to say that one meter is purposely arranged to run slow. A much better plan is to use two special meters each fitted with a single large dial and only one hand, the latter being arranged to run round at a fair speed. No one can then fail to be struck with the difference between the rates of rotation, and by having a change-over switch, each lamp can be thrown on to either meter, the sudden change being most marked, and very convincing.

We should be happy to supply particulars of these meters to any of your readers who are interested.

For **Venner & Co.,**
Ernest E. Sharp, *Manager.*

London, S.W., *March 7th*, 1910.

Contractor or Manufacturer?

My letter of February 18th was not written with the object of raising trouble with contractors, but to endeavour to get a more definite understanding as to the difficulties between the contractors and the supply authorities, and to stop the objectionable tone in which this matter was being discussed.

"Fair Play" states that he is fully acquainted with the matter under discussion. I consider that the contents of his letter prove that his information is superficial and prejudiced. I believe his remark applies rather to a side issue only.

My letter was not intended as an argument for municipal trading, but to urge that electric supply, whether under company or municipal control, should be developed to the best of the ability of those responsible, whether directors, committees, or managers.

The writer's remarks with reference to publicity departments and their connection with local contractors is one point on which his experience proves to have been of a superficial nature, and these are so obviously biased that I do not propose to occupy your columns in replying to them.

The electrical Press has been urging the necessity of publicity departments for increasing business, and such are generally recognised as a necessity unless amongst some of "Fair Play's" hidebound friends.

It is interesting to learn that over-competition produces vigorous canvassing on the part of contractors. This is by no means in accord with my experience.

"Fair Play's" reference to introduction of motor manufacturers to factory owners shows a considerable lack of knowledge of facts, otherwise he would know that factory owners never dream of going to small local contractors, who, perhaps, have only done one or two small motor jobs during the whole of their experience.

Factory owners obtain discount from the manufacturers, and are keen enough to see that they get it, and it is not a question of introduction from the supply people.

On the question of contractors being harassed by the publicity department, the writer should not forget that the supply authorities have to be alive with the consumer, and it is to their interests to see that the consumer is supplied with an installation, the annual cost of which shall not exceed what the consumer is in a position to pay.

Contractors sometimes persuade people to go in for expensive schemes so as to get a larger profit. When the account for current is received the consumer becomes dissatisfied; the contractor, however, has lost interest and responsibility with receipt of his cheque.

My position in this matter has been, as "Fair Play" should know, if he really is fully acquainted with the matter, to urge co-operation.

The writer's reference to the relation between the contractors and the electricity committees is certainly amusing. I am glad, however, that he does not attempt to justify such action.

I have no objection to contractors. I consider they may be a useful adjunct to the supply undertaking, and I want to live in harmony with them, but my conditions are that:

"they play the game;" and work with the supply manager to develop the supply business as hard as possible.

During the last few months, however, I have been driven more and more to the conclusion that certain contractors do not seriously wish to work in with the supply manager, and appear to be rather anxious to commit "business suicide," as unless there is co-operation in the future, the only alternative is a vigorous wiring department carried on by the supply authority to meet the competition of the gas undertakings which have already such departments.

Alex. C. Cramb,
Borough Electrical Engineer.

Croydon, *March 7th*, 1910.

In reply to your correspondent "Fair Play," his remarks *re* publicity department being a thorn in the flesh are quite right, but he should have said in the flesh of the contractor, and not the supply company.

The duty of the canvasser is to his employers, and to his prospective consumer. His advice to the consumer is for the best method, and the maximum amount of illumination for the minimum cost of energy, and it is no part of his duty to advise the consumer to lay out a fabulous sum, as some contractors are so fond of doing, solely for their own benefit.

"Fair Play's" remarks as to men and boys doing the canvassing work are quite in keeping with his ignorance of the duties of a publicity department. I suppose he does not know that every consumer is worth keeping on the mains. Half a canvasser's time is taken up with complaints, and it may be news to "Fair Play" that a great proportion of the complaints are due to bad work on the part of the contractor.

What a large number of engineers and experts ("Fair Play's" own words) there are in installation work, and what a lot of tinkers and tailors. I wonder how many of them could show their apprenticeship papers. Many canvassers would be ashamed to own some of the illuminating effects produced by these experts.

We hear a lot of talk about the hard work in canvassing done by contractors. How much is done in practice! Very little, and what little is done is in quite a half-hearted manner. He waits, like Mr. Micawber, for something to turn up.

What a huge mistake to have a supply canvasser call upon a new tenant of a house or shop and find that a few contractors have already been there. You will always find this in the main roads, where the contractor cannot help seeing there is a job going. Does the contractor ever enter the by-ways? No! If he did, he would find that the canvasser had been there weeks or months before it had ever struck the contractor to look there. Whatever may be "Fair Play's" opinion, it is an undoubted fact that the supply canvasser gets more consumers for the department than the contractor does. "Fair Play" can, by investing in a penny stamp, get the information he requires, *re* hire-purchase motors (it comes as a shock to find a contractor doesn't know this) from the manufacturers and sellers; if not, I shall be pleased to inform him.

How, if in his business dealings with canvassers he hands over the application forms in return for "like services," does he justify the name of "Fair Play"? His insinuations are unjust, and can only spring from one who can only obtain business by practising these dealings.

I regret the extent of this letter, but must in justice defend the poorly paid and very much libelled

Canvasser.

My attention has been called to the correspondence emanating from our borough electrical engineer in your issue of the 18th ult.; as I happen to be one of those members serving on the Electric Light Committee at Croydon, the information which Mr. Cramb offers concerning contractors and our committee is quite foreign to me, and I shall feel it my duty at our next meeting to ask for an explanation of this correspondence, as I cannot conceive such matters between committee and engineer being discussed in public. There is beyond a doubt a great feeling existing, not only in this but other towns, against municipal trading, and rightly so. For my own part, I can quite see that electrical contractors have great difficulty to make both ends meet, without the addition of this proposed trading which Mr. Cramb seems so impatient to participate in, and against which issue I shall use my best endeavours to protect the interest of those whom I have the honour to represent.

Leonard Stevens.

Croydon, *March 7th*, 1910.

The only advantage to be gained by such a letter as that written by Mr. Cramb is to expose to the public eye the state of affairs that exists in Croydon at the present time; the old French proverb fits the case admirably: "Qui s'excuse s'accuse."

The bulk of the work in Croydon is at present in the hands of one or two contractors; electrical engineers, I believe, they call themselves, while the remaining firms are not even allowed the crumbs; their work, name and character is ruined by reports circulated—of course, by nobody.

I understand that the whole trouble originates from that "white elephant," the showrooms; the latter are managed by a few men who are thoroughly ignorant, both as regards electrical details and ordinary business methods, simply because they have never had the necessary experience; these gentlemen pass on possible consumers to their pet contractors. Is it fair that those who pay their rates—in some cases have paid them for nearly half a century—should have their work literally taken out of their hands? If this sort of thing goes on there will be no trade of any description left in the town; but this is only one of the many evils of the whole system. I am thinking that if certain transactions were looked into, the number of really good men who are now out of work would be considerably reduced—"a rude awakening."

Au Fait.

A NEW SYSTEM OF TELEPHOTOGRAPHY

Herr R. Schonhofer suggests the following arrangement for transmitting reproductions of pictures or of actual objects to a distance. The view to be transmitted is thrown, greatly magnified, by the projection apparatus A (fig. 1) on to a screen W_s, composed of a large number of selenium cells. Wires connect these cells to a synchronous commutator S_1, to the brush of which the transmission line, with a battery E in it, is connected. At the receiving station a second synchronous commutator S_2 takes up the signals and

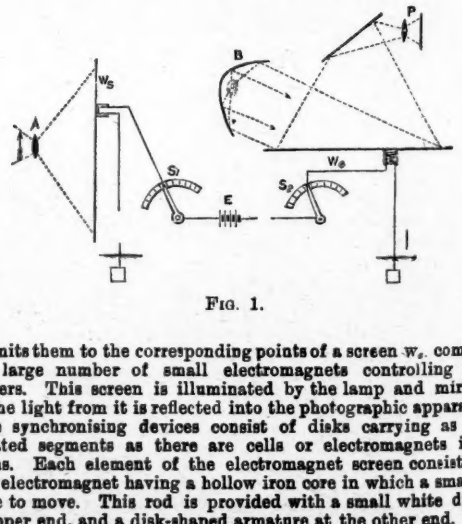


Fig. 1.

transmits them to the corresponding points of a screen W_e, composed of a large number of small electromagnets controlling small plungers. This screen is illuminated by the lamp and mirror B, and the light from it is reflected into the photographic apparatus P.

The synchronising devices consist of disks carrying as many insulated segments as there are cells or electromagnets in the screens. Each element of the electromagnet screen consists of a small electromagnet having a hollow iron core in which a small rod is free to move. This rod is provided with a small white disk at the upper end, and a disk-shaped armature at the other end.

Each selenium cell at the transmitting station receives definite illumination dependent on its position in the picture. This remains constant during the whole time of transmission. The resistance of the selenium cell therefore falls to a definite steady value. The synchronous device, in its rotation, connects each selenium cell in

turn to its corresponding electromagnet, and the latter consequently receives a current dependent on the illumination falling on the former. The small white disk in each electromagnet is attracted upwards more or less according to the current, and becomes lifted into a position where it receives more or less illumination from the mirror B. The result is that the whole surface of the electromagnet screen W, is broken up into numerous patches of greater or less illumination, according to the illumination in the corresponding point on the selenium cell screen, and consequently the whole picture thrown on the latter is reproduced at the former, as far as light and shade distribution is concerned. The time taken to transmit a picture is given as about two seconds. No details of construction are given, but the cost of the apparatus is admitted to be great, though not prohibitive, considering the important benefits of such a transmision if successful.—*E.T.Z.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Electric Bell.

That there is still room for novelty in the design of electric bells is well shown by the accompanying illustrations relating to a bell introduced by Messrs. A. Emanuel & Sons, Ltd., of 13, George Street, London, W. The obvious advantage of energising electric bells from the lighting circuits, and thus dispensing with the use of primary batteries, has led to the development of various patterns of high voltage bells; the chief difficulty in connection with these has been the tendency to destructive sparking at the contacts, due to the high pressure, which can only be mitigated and not obviated in the ordinary arrangement. In the device here illustrated, however, this is completely overcome.

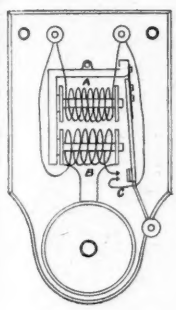


Fig. 1.—Winding of H.V. Bell.

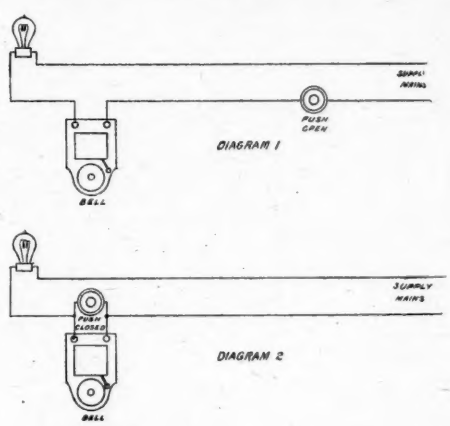


Fig. 2.—Circuit Connections.

From fig. 1 it will be seen that one coil A of the electromagnet is connected directly to the terminals of the bell; whenever the external circuit is complete, therefore, current traverses this coil, and tends to attract the armature. The movement of the latter closes at C the circuit of the second coil B, which is wound in such a sense as to oppose the magnetic effect of the first coil, and thus the attraction ceases, the armature recoils, and the cycle begins anew. A glow lamp is placed in the circuit to serve as a resistance to control the current strength. A very important feature of the device is that the contacts are always shunted with a low resistance coil, and only deal with the small drop in volts across that coil; thus they never interrupt the main circuit at all, and sparking is absent.

The lamp used for a resistance need not be set aside for this purpose; by the addition of a small switch and an extra push, it is made available for use when required. Thus, in fig. 2, diagram 1, the connections during the day-time are shown; when the bell is rung, the lamp momentarily lights up. Diagram 2 shows the arrangement at night-time; the lamp is on, but the terminals of the bell are short-circuited by a push, which, when actuated, allows the bell to ring, without affecting the lamp. Fig. 3 shows an important application of the system—namely, to the bell on a tramcar. The diagrams are practically self-explanatory, and it will be evident that this invention provides a completely satisfactory solution to the problem. The inventor, we believe, is Mr. E. Parkes, of the same firm.

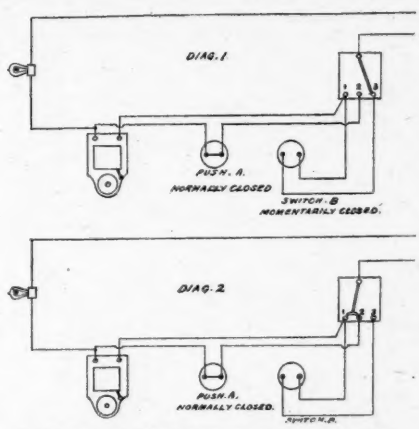


Diagram 1.—Switch at 3: closing of B rings bell.
Diagram 2.—Switch connecting 1 and 2 together; opening of A rings bell, lamp burning.

Fig. 3.—Application to Tramcar.

Westinghouse Portable Compressor Sets.

The accompanying illustrations, figs. 4 and 5, show a small portable air compressor recently supplied through Mr. C. J. Wharton, consulting engineer, London, to the Rio de Janeiro Flour Mills and Granaries Co., Ltd., by the British Westinghouse Electric and Manufacturing Co., Ltd., who a short time previously electrically equipped these mills.

The apparatus consists of a standard Westinghouse air-brake compressor, driven through single-reduction gear by a 3-H.P. Westinghouse three-phase squirrel-cage motor; this is mounted on a wooden trolley with rubber-tired wheels, together with control panel, &c., which is coupled by a flexible cable and plug to suitable wall sockets.

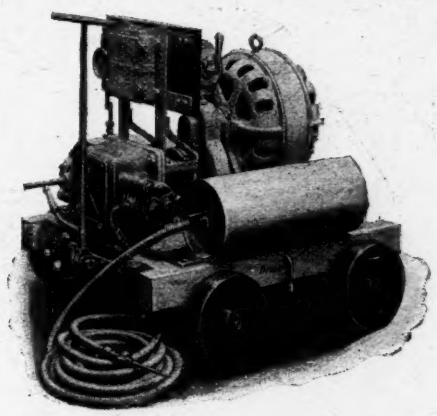


Fig. 4.—Westinghouse Portable Compressor.

The controller panel is arranged so that when the motor is thrown on to the line at starting, the fuses are cut out, and after the motor has attained a fair speed the switch is thrown over to the other side, putting the fuses in circuit.

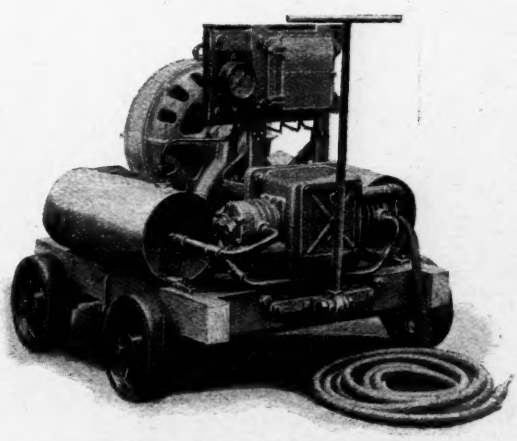


Fig. 5.—Portable Compressor.

This plant will be used for blowing out and cleaning the 600-H.P. Westinghouse motors and other plant in the above-mentioned mills.

"Brooke" Petrol-Electric Set.

Messrs. J. W. Brooke & Co., Ltd., of Lowestoft, are exhibiting at the forthcoming Aero and Motor-Boat Exhibition one of their small petrol-electric sets, which have been extensively used for

country-house and yacht lighting. We illustrate in fig. 6 a 4-H.P. Brooke petrol motor, direct coupled to a G.E.C. 1·6 KW. 50-volt dynamo, giving 32 amperes at 900 R.P.M. The engine is of the four-stroke cycle type, with extended crank-shaft and starting gear at forward end. Both engine and dynamo are mounted on a cast-iron bedplate, into which is cast the silencer; a centrifugal

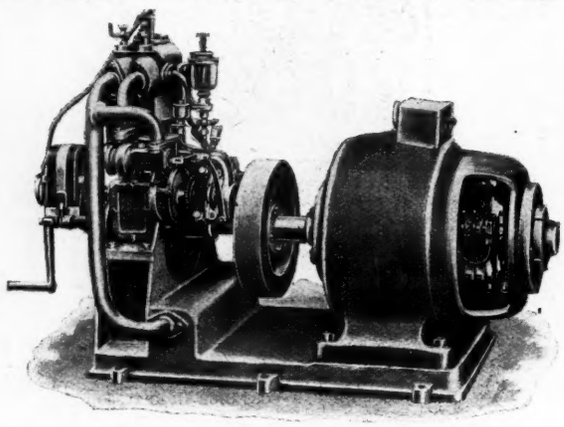


FIG. 6.—BROOKE PETROL-ELECTRIC SET.

governor is fitted at the end of the cam-shaft, acting direct on a Brooke carburetter, and either splash or drip lubrication can be adopted. We understand that these small sets are running very satisfactorily.

Bristol Electric Safety Lamp.

We have received from the BRISTOL ELECTRIC SAFETY LAMP WORKS, 40, Great Smith Street, S.W., a handsome portable safety lamp, as illustrated in fig. 7, a new type recently brought out by the company. The lamp case is of aluminium, and the total weight, with a 4-volt accumulator, is only 3 lb. 6 oz. The battery is of a non-spilling type, and can feed the lamp for 10 hours on one charge; the connections are made in the act of sliding the battery into the case, and the lid is locked with a special screw-key. The lamp has a metallic filament burning at high efficiency, and gives a remarkable quantity of light. The charging rate is 0·6 ampere. Simplicity and neatness are marked features of the device, which appears to be quite well adapted for use in mines, warehouses, &c., and we do not hesitate to give it our cordial approval.

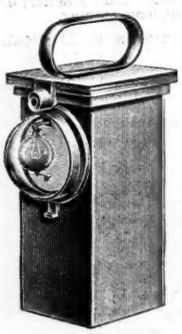


FIG. 7.—BRISTOL ELECTRIC SAFETY LAMP.

"Multicore" Ignition Cables.

In our last issue we briefly referred to the LIVERPOOL CABLE CO.'s "Multicore" ignition cable system (Simplex patents), which has several obvious advantages for motor-ignition purposes.

With the advent of four and six-cylinder engines for motor-car and suchlike work, the question of suitably placing the ignition wiring assumes considerable importance, as on this wiring depends the satisfactory operation of the car. The Liverpool "Multicore" ignition cable system is a most effective remedy for wiring troubles, being a thoroughly mechanical adaptation of an electrical system.

Fig. 8 shows a complete wiring equipment, from the magneto to the sparking-plugs, with a sectional view of the cable employed, the latter consisting of a solid ebonite rod with the wires moulded inside. Short flexible leads run from brass connectors on the cable to the distributor or magneto, while solid connections, hinged at the cable and forming insulated switches, connect the cable on to the sparking-plugs direct. The ebonite cable is oil and water proof, and is finished off with a polished surface; it is unaffected by the heat of the engine, and is tested before leaving the works with a pressure from a 7-H.P. transformer sufficient to give a spark of 2 in. in air, or four times the usual working spark. The Sheffield "Simplex" cars have been exclusively fitted with the system for 2½ years, and no case of breakdown has been reported; and its neatness, and freedom from complication and damage, have attracted much attention.

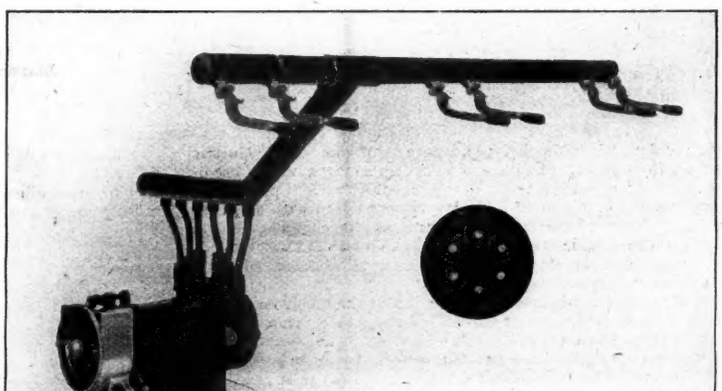


FIG. 8.—LIVERPOOL MULTICORE IGNITION CABLE SYSTEM.

The "Electric Mary Ann."

This handy device takes the shape of a portable combined electric motor and driving gear, so arranged that the one apparatus can drive any standard domestic labour saving machines. Attached to the motor base, fig. 9, is a radius arm, carrying a pulley driven at reduced speed by a belt from the motor spindle. To the pulley is rigidly attached a small friction wheel, which can be placed in contact with the driving pulley of any appliance that it is desired to drive. A spring mounted at the tail end of the radius-arm ensures that the friction wheel is pressed against the pulley of the machine sufficiently hard to drive it.

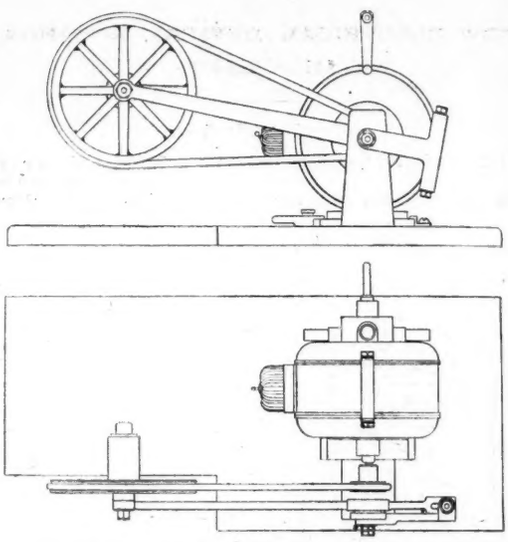


FIG. 9.—ELEVATION AND PLAN OF THE "ELECTRIC MARY ANN."

Thus it will be seen that the "Electric Servant" will drive any standard household machine that has an existing pulley by simply resting upon it. Any domestic appliance that is fitted with a cranked handle is driven by removing the handle and substituting for it one of the adapters supplied with the "Electric Mary Ann," upon which a pulley is fitted. Polishing work, boot cleaning, &c., are done with a flexible shaft connected directly to the spindle of the motor. There are a large number of machines that can be driven by the "Electric Servant," and much time can be saved by its use, the work also being done better.

Among the most important uses of this gear are those of driving vacuum carpet cleaners, sewing machines, knife cleaners, and polishers. At the same time, the owner of a house equipped with

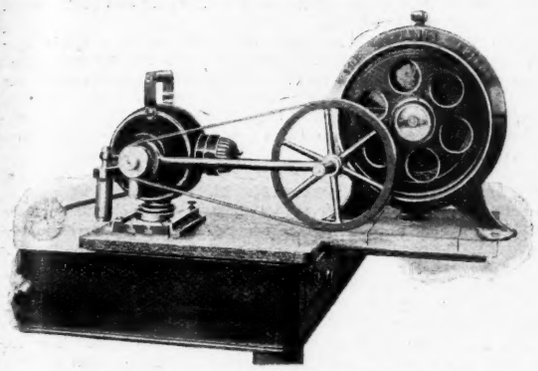


Fig. 10.—"Mary Ann" driving a Knife-cleaner.

an electric servant can also take advantage of it to drive a number of things for which, in the ordinary course, it would not be worth while to purchase an expensive electric motor.

The "Electric Servant" is fitted with a large and convenient handle, so that it can easily be carried to any part of the house where its services are required. It can be connected to any lighting

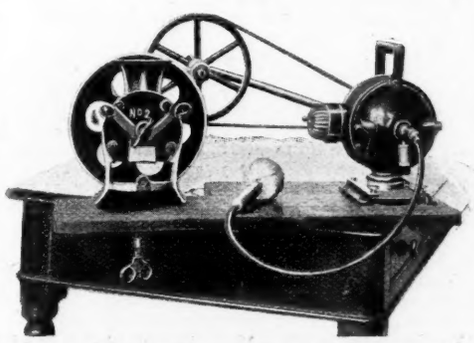


Fig. 11.—"Mary Ann" driving a Coffee-grinder and Polishing Bob.

circuit by way of a lampholder, and only consumes about 120 watt at full load. It should prove of considerable value in popularising the domestic applications of electricity, and the inventor—Mr. R Borlase Matthews, of Bank Buildings, Kingsway, W.C.—gives a list of fully 50 different domestic machines to which it may be applied.

LEGAL.

The Ethelburgha Syndicate, Ltd., *v.* The India-Rubber, Gutta-Percha and Telegraph Works Co, and Another.

As briefly mentioned last week this case was opened on March 2nd, in the King's Bench Division, before Mr. Justice Lawrence and a special jury. It was an action for damages for alleged breach of contract to lay a cable between Columbia and Jamaica, and the action was also brought against Mr. R. K. Gray for breach of warranty of authority in respect to the same matter. The defence was a denial of the alleged breach. Mr. Eldon Bankes, K.C., Mr. J. R. Atkin, K.C., and Mr. W. Williams were for the plaintiffs, and Mr. M'Lusb, K.C., Mr. Simon, K.C., and Mr. Macpherson for the defendants.

Mr. Bankes, in opening the case, said the plaintiffs claimed damages for breach of a contract which they alleged was made between the defendants and themselves. The amount claimed consisted partly of a considerable sum which they expended on the faith of the contract and which had been entirely thrown away, and partly of profits which they said they would have made if the contract had been carried out. The plaintiff company was a small syndicate consisting of a number of influential people, which was formed in 1902 with a capital of £20,000 for the purpose of taking up financial schemes and concessions, and they had done a very successful business. There were three directors—Mr. O. H. Fuerth, the chairman, the Hon. Arthur Stanley and Mr. F. W. Voules. There was also a Mr. Pam, an alternative director, who acted for Mr. Fuerth when he was away. The defendant company, the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, was a well known company, a constructor of submarine cables, &c. The business was mainly carried on through Mr. Robert K. Gray, their managing director, with whom in this case all the negotiations were carried on, and the contract made. The action had reference to a contract made between the two companies with regard to the taking up and working of a concession which had been granted by the Government of the Republic of Columbia to Mr. Fernandez He was the Government Director of Telegraphs in that Republic, and in 1905 he obtained from the Government a concession which apparently everybody thought was a valuable one. This gave Mr. Fernandez the exclusive right to lay a submarine cable from the shores of the Republic, to some point where it would meet with an existing system in the Atlantic. The concession also gave him the exclusive right to lay and work a telephone system, and to undertake other works. The concession was accompanied by a guarantee from the Government of a return of 7 per cent. upon every $2,571 gold expended per kilometre of cable laid. They also guaranteed a sum of money per annum. The plaintiff syndicate first heard about the concession in 1907. It was introduced to Mr. Fuerth as a profitable piece of business if his company was prepared to take it up. On March 14th, 1907, Mr. Fernandez granted to Mr. Fuerth, on behalf of the syndicate, an option for a limited time, and it was conditional that a company should be formed with a capital of £400,000, to take over the concession. Mr. Fernandez was to have a third of the shares. Mr. Fuerth had accordingly to see whether he could carry through the negotiations for the formation of a company, and the first thing was to find a company which would be prepared to make and lay a cable from the coast of the Republic of Columbia to Kingston, Jamaica, because the Direct West India Co. was there. Communications were opened with the chairman of this company, with a view to ascertain the position, and to see if he could offer them any assistance. He recommended plaintiffs to see Mr. Gray, who was the representative of an influential company whose business it was to make and lay these cables. Mr. Voules and Mr. Pam accordingly got into communication with Mr. Gray, who considered the matter, and said the first thing that struck him was that the proposed company was over capitalised. He suggested it should be £100,000, and that it should have an issue of £100,000 first mortgage debentures, and £50,000 second mortgage debentures. The members of the plaintiff syndicate agreed to these terms. On April 9th, 1907, an interview took place between Mr. Pam and Mr. Gray, and the matter was thoroughly thrashed out. Mr. Gray said it was important that the Republic should stand by their guarantee and that nothing should be said or done which would give them the smallest opportunity to say that they would not be bound by it. He thought the estimate per kilometre laid was too high, and that it would not cost so much, and he said if the Government found that out they would very likely say they would not be bound by their guarantee. Therefore, Mr. Gray suggested the estimate should be altered to £32 per kilometre of cable laid. He said if these alterations were made, his company would be prepared to favourably consider a proposal to make and lay the cable. They would work the cable for a year and take any receipts for working it, and they would find a sufficient sum to provide working capital for the company. For this they would expect £90,000 of the issue of the first mortgage debentures, and 30,000 shares. The result of this was that the syndicate exercised the option with Fernandez, and bought the concession. Mr. Fernandez said he should expect £6 000 in cash and 5,000 additional shares, besides what he had been promised, and the syndicate closed with him, as they were the best terms that could be made. Throughout the representatives of the plaintiff company were in constant communication with Mr. Gray. It was found necessary to send out a representative with Mr. Fernandez holding a power of attorney, in order that he might negotiate with the Government. Before they started there was an interview with Mr. Pam and Mr. Gray, and plaintiffs' case was that Mr. Gray definitely, and on behalf of his company, agreed to the proposals which were as follows:—That the syndicate should form a company with a capital of £100,000, and Mr. Gray's company was to make and lay the cable, work it for a year, and provide all the expenses for the first year; also to take the receipts for the first year and provide a certain amount of working capital. A new arrangement was also made with Fernandez. A company was registered under the name of the Carribean and Anglo-Columbian Cable Co., Ltd. It was essential that the cable should be working by January, 1909, and that was an important matter for the jury to remember, because he should be able to satisfy them that owing to the way the plaintiffs were treated by the defendants they lost the valuable concession, because the defendants repudiated the contract at so late a date that it was impossible for the plaintiffs to get anybody else to put down the cable in the time specified by the Government. Plaintiffs asked for an extension of the time, but this was refused, and the plaintiffs not only lost their concession, but also the money they had spent on the matter. On November 4th, 1907, Mr. Gray wrote the following letter to Mr. Voules in reply to a letter setting out the terms of the arrangement:—"I have to acknowledge your letter in which you state the substance of the understanding arrived at in the interview between your Mr. Pam and we, viz, that my company is willing to make and lay the whole of the Jamaica-Columbian cable at an approximate cost of £62,000; £20,000 is to be paid to this company in cash by the Ethelburgha Syndicate, and the remainder—£42,000—to be satisfied by the allotment to this company of first debentures at £92, with a bonus of 60 per cent. in ordinary shares. We further undertake to keep the cable in order for one year after the completion of laying, and also to furnish the company when and as required with £16,500 for this purpose, and provide necessary funds for working capital and other purposes. In respect to the payment of the £16,500, my company

is to receive further debentures as above at £92, with a similar bonus at 60 per cent. in ordinary shares. It is understood that the company whose debentures are referred to will be constituted with a capital of £200,000 in £1 ordinary shares, £110,000 first debentures at 6 per cent., and £50,000 second debentures."

Negotiations continued, but ultimately on April 1st, 1908, the defendant company said they were going to have nothing to do with the matter, and that they had not bound themselves to anything. The jury had to decide whether the defendants were bound by this or not, whether they had made fools of the plaintiff company or only of themselves. The defendants in their defence said there never was a concluded bargain, but that the matter rested in negotiations. No doubt the matter was not concluded, because the parties wanted the terms put in legal phraseology, but that did not prevent what was agreed to being a bargain between the parties.

Mr. A. Pam deposed to the negotiations which took place between the parties which led up to the arrangement made.

Mr. Lush said the defendants' case was that there had been no agreement.

In cross-examination by Mr. Lush, Witness admitted that there had been no concluded agreement between the parties when the agreement was made as to the purchase of the concession. The cost of laying the cable was to be about £65,000, and the working capital of the company to be £16,500, furnished by defendants. Mr. Gray was to run the company for the first year, and at the end of that time he was to hand over the balance of working capital, if any, to the company which was to be formed.

In further cross-examination, Mr. Pam said he did not think it was absolutely essential that the defendant company should, before binding themselves to the contract, make inquiries as to the landing rights] in Jamaica. There was no reason why these should be refused.

Mr. Lush: That is a question of rights and concessions. Witness: It is only a question of concession. He did not know it was of vital importance to the defendant company to make pooling arrangements with the Jamaica people so as to show a profit on the undertaking.

Mr. F. W. Voules, director of the plaintiff company, deposed to his introduction to Mr. Gray and to the interviews and negotiations which followed.

On Thursday Mr. Voules was cross-examined by Mr. Simon, K.C. He said there was no special specification with regard to the cable to be drafted, but there was a common form which had been agreed upon on May 9th. In that month they had a conditional agreement depending on them obtaining certain modifications in the concessions. In November, after the modifications had been obtained, they had nothing except details to deal with. There was no record of this agreement in the minute book, as it was not the practice of the company to enter documents not under seal. The plaintiffs had bargained with Mr. Gray that his company should make and lay the cable for a certain sum in debentures and shares in a company to be formed, and he really did not care whether the cable was to cost £62,000, as proposed, or £62,000,000. After November 4th, 1907, there was no question of a proposed agreement. The only question was the drawing up of the agreement by solicitors.

Then why on November 22nd did you write: "In consequence of the terms of the proposed agreement not having been settled?" —I think the wording of the letter was unfortunate.

Was it injudicious?—It was unfortunate.

His Lordship: I do not know what you mean by unfortunate. You were saying one thing one day and another the next.

Witness: Mr. Gray said he agreed to the terms of the letter, and his solicitors would be instructed to draw up the contract.

Then your letter was injudicious?—Yes.

Further cross-examined, Witness said the whole thing was practically agreed between the parties on November 4th, and it only remained for the solicitors to draw up the legal contracts. He admitted he referred to the matter in the words "if we are to get on with this matter," but he said this did not affect the agreed contract. Mr. Rippon had at this time agreed that the proposed cable should connect on with the existing one at Kingston, but the apportionment of the rates had not been made, and there were some smaller details, such as the landing of the cable, &c., which remained to be settled. He distinctly asserted that Mr. Gray's letter of November 4th was a binding agreement. There was a common form of specification which had been agreed upon by the parties.

Do you say you could have an agreement for the laying of a cable of this character without having an agreement as to what the sheathing should be?—I can't tell.

Or as to whether the core was to be covered with jute yarn, gutta-percha, and so forth?—I don't know.

Have you not to have compositions for the different stresses and waves according as it is to be on the top of the sea or the bottom? —I don't know.

Mr. Otto Fuerth said he was one of the directors of the plaintiff company, and Mr. Pam was his alternative director. An alternative director had to be provided, as witness was very much abroad, having an office in Paris. Witness negotiated the option letter of March 14th, which started the negotiations, and he then handed them over to his colleagues to carry out.

Cross-examined by Mr Simon, Witness said if the defendants had given him notice that they would do nothing before they did, he would not have sued them, because he could have got the business done elsewhere. But he nevertheless thought there was ground for suing.

This concluded the evidence.

Mr. Lush, K.C., then submitted that no case had been made by the plaintiffs to go to the jury. The plaintiffs must show that there was a definite and concluded contract entered into between the two companies containing all the substantial terms of the bargain, and that they had not done. There was authority to say that it would be wrong to hold there was a concluded contract merely because there were a few letters between the parties which looked as if they had come to terms.

Mr. J. R. Atkin, K.C., in reply, contended that a complete contract had been concluded, and that was shown by the correspondence which had passed. The point to be decided was whether the parties intended to come to a contract, and that could only be decided by evidence.

His Lordship said he held there was no case to go to the jury. He was not prepared to deal with the whole question then, as it would not be respectful to the Court of Appeal not to give at length his reasons for the decision. He would only say that he had come to the conclusion that the letters of November 4th did not form a concluded contract—that was to say, that the matter stood as it stood after considerable negotiation. He thought the interviews showed there was negotiations going on almost up to the end of the time when the matter was finally broken off.

Mr. Simon said he understood the matter would be put in the list, and his Lordship would give his reasons at length.

His Lordship assented, and judgment was given for the defendants, a stay of execution being allowed on the usual terms.

Luscombe *v.* Fryer.

Mr. Muir Mackenzie, one of the Official Referees, on March 4th, 5th and 7th, heard in the High Court the action of Luscombe *v.* Fryer, on a claim by John Francis Luscombe, of Norwood, against W. J. Fryer, trading as W. J. Fryer & Co., of Bravington Road, Paddington, for alleged wrongful dismissal.

Mr. F. Watt appeared for the plaintiff, and Mr. P. B. Morle for the defendant.

Plaintiff's case was that he was engaged by the defendant as an electrical and mechanical engineer, and that amongst his duties he was to do office work, to travel, and to obtain orders for the engineering department, at a yearly salary of £100, and 10 per cent. commission. He entered upon his duties in February, 1909, and continued until April 13th, when, as he alleged, the defendant terminated the agreement without just cause, and wrongfully dismissed him. He declared, in evidence, that he had given his best attention to his duties, and had even given up his time on Sundays to the work. In addition to damages he claimed commission and one month's salary.

The Defendant denied that the dismissal was wrongful, and pleaded justification, alleging that the plaintiff had shown incompetency, whereas he had been engaged on the distinct understanding that he was an experienced and reasonably competent man. He also accused the plaintiff of neglect of duty, and alleged that three consulting engineers, including the engineer to the Metropolitan Asylums Board, had complained that plaintiff had not given the proper attention to their orders. He also declared that plaintiff had, without his knowledge, endeavoured to alter the time of an appointment with a consulting engineer at the approach of the Easter holidays, with the result that the consulting engineer, who had desired to see him later in the day as the time suggested by the plaintiff did not suit his convenience, was much annoyed.

Plaintiff, in the course of his evidence, denied emphatically these allegations and, in regard to the question of his competence, furnished particulars of his experience under various firms and undertakings he had served at home and abroad. He also produced testimonials.

In the course of cross-examination, he stated that no particular time was fixed by the firm for starting business in the morning. The electrical was one department of Fryer's business, and he (the witness) was at the head of it. He did not suggest that he got all the orders himself.

In re-examination, Mr. Luscombe said he was sole manager of this department, and only saw Mr. Fryer about once a week. Nothing had been said to him about office hours or about coming late. The usual office hours were from 9 or 9.30 to 6 in the evening, although he usually left between 7 and 8. Mr. Fryer prevented him from keeping an appointment at Carshalton; Mr. Fryer had told him he would deal with the matter himself, and gave witness three other appointments.

Three radiators, he continued, were needed for the Children's Hospital at Carshalton. He (Witness) saw the engineer of the Infirmary, and took the measurements. He got out an estimate, and showed it to Mr. Fryer. The original price he estimated for the work was £48. That was too high, and Mr. Fryer afterwards cut it down to £34 18s., and said this was advisable, as other contracts were coming on. He knew there was a £5,000 contract coming on. Mr. Fryer said it would not be necessary to submit samples. He had no recollection of the foreman complaining that the work was all wrong. On the Carshalton job only the tubing was started in witness's time.

Mr. Fryer, the defendant, stated that when the Metropolitan Asylums Board wrote and asked his company to tender for the work at the Children's Home at Carshalton, he handed the letter to Mr. Luscombe, who went down and got the measurements. After taking these particulars, the plaintiff delivered the order for the materials. He had a conversation with Mr. Luscombe as to the profit. First, the price was fixed at £34, then raised to £48, and afterwards fixed at £36 18s. 7d. The firm had worked for the Metropolitan Asylums Board for some time, and their estimate for the £5,000 job had already gone in, so there was no necessity for

considering that in tendering. There was no further work to come from Carshalton. There was a standard specification for the work of the Metropolitan Asylums Board. On February 8th they got the order, the materials to be appoved by the Board. They always had to send samples to the chief engineer, and the samples had to remain with him until the completion of the job. Mr. Luscombe said he fixed enamelled tubing, and it had to be removed, galvanised tubing being fixed in its place in accordance with the specifications. The Board always used galvanised tubing. They had to have the work re-done, with the result that there was a loss. The switches fixed "heated," and this was a very serious matter. Mr. Fryer mentioned that Mr. Albion T. Snell, the consulting engineer, had complained in reference to the plaintiff, because the latter had desired to alter the time of an appointment. The only reason for plaintiff wishing to alter the appointment was that he could take himself off for the afternoon without permission.

Mr. Watt: You do not expect him to be there on Good Friday? —Yes, if you have a rush job on. He should have visited that job on Good Friday if necessary. I expected him to be there on the Saturday.

Do you say he had no right to go away the Thursday afternoon if he had finished the work?—He had no right to do that, and especially to put off an appointment to do so.

Mr. Hugh Bourne, chief assistant to Mr. Albion T. Snell, gave evidence regarding appointments, and stated in cross-examination that he supported the application of the plaintiff for admission to the Institution of Electrical Engineers, which had been seconded by Mr. Snell.

Mr. Russell Hudson, an assistant engineer in the employ of the Metropolitan Asylums Board, also gave evidence.

After further evidence on both sides and addresses by counsel, the Official Referee said he would reserve judgment.

Byatt *v.* The Krieger Electric Carriage Syndicate, Ltd.

The defendants' appeal in this action from a judgment of Mr. Justice Grantham on the finding of a special jury in the plaintiff's favour for £1,340 for personal injuries, was settled before the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley on Monday last. Miss Ivy Byatt, 24 years of age, the daughter of Henry Byatt, novelist, of 36, Warwick Gardens, was knocked down by one of the defendants' electric broughams, while cycling in the neighbourhood of Queen's Gate, and she died shortly after the case was heard.

Mr. Lush, K.C., for the defendants, now stated that though they were advised that they were not liable, they were desirous of doing what was fair. They were willing to pay the lady's father £500 in addition to £500 already paid, and which they had undertaken not to ask for the return of, even if successful on the appeal, allow the father to retain the taxed costs, and to give him an extra £50 on condition that the appeal should be withdrawn, no costs being allowed.

Mr. P. Hastings, for Mr. Byatt, accepted those terms, and the appeal was withdrawn accordingly.

Horsfall Destructor Co, Ltd.

A petition for the winding-up of this company was before Mr. Justice Neville on Tuesday last, but it was stated that arrangements had been come to, and the petitioners, the Earl of Dudley's Round Oak Works, Ltd., were willing that the petition should be withdrawn. There was no opposition to this course being adopted, and the petition was withdrawn accordingly.

Unique Accident to Canadian Hydro-Electric Plant.—Our contemporary, the *Canadian Electrical News*, quoting an extract from the general manager's report, gives an interesting account of the accident which occurred at the Winnipeg Railway Power Plant, at Lac du Bonnet, on November 23rd last. From this it appears that the station was carrying some 12,700 kw. of load, nine sets being in use, when, without warning, the penstock burst adjacent to No. 7 unit, which was carrying 2,000 kw., two plates giving way, and leaving an opening some 12 ft. × 9 ft. The liberated water made a huge breach in the wall between wheel sets 7 and 8, and flowed directly on to No. 8 generator, filling that end of the engine room to a depth of 8 to 10 ft., and ultimately flooding the entire plant. The men at the gates of No. 7 unit barely escaped with their lives, one being swept out of the building by the rush of water; owing to the latter men had to be lowered by ropes from the wheel-house roof, and in some 4 or 5 ft. of water succeeded in stopping all the wheels, except Nos. 8 and 9, which were submerged. It was found impossible to lower the head gates to stop the water, owing to the pressure on the gates, and this was only done when the gates had been shielded by means of piles driven in front, and covered with sheeting, sand bags, &c. Despite the magnitude of the accident, it is satisfactory to note that one unit with temporary wiring was in service again, delivering 1,500 kw. only six days after the shut-down, assisting the disused steam plant in Winnipeg, which had been pressed into service again in the emergency. Expert opinion favours the view that some teeth stripped from a pinion on the governor, and allowed the turbine gates to close suddenly, thus causing the penstock to burst.

THE ELECTRICAL INDUSTRY.

We have received the following communication, to which we allude in a leaderette appearing in this issue:—

The Editors, Electrical Review,
4, Ludgate Hill, E.C.

Dear Sirs,—The undermentioned have decided to constitute themselves into a provisional Committee to take such steps as may be found advisable in furtherance of the legislative industrial and commercial interests of electrical industries.

Every effort will be made to work in co-operation with all existing electrical Societies.

Any member of the industry in sympathy with this movement is asked to communicate with the hon. secretary or any member of the committee.

A further announcement on the subject will be made at an early date.

G. L. Addenbrooke, M.I.E.E.
A. Bruce Anderson
A. K. Baylor, M.I.E.E.
Lt.-Col. H. R. Beddoes
E. Bergtheil, M.I.E.E.
J. Cecil Bull. A I E.E.
E. Charrington, A.M.I.C.E.
A. N. Connett, M.I.C.E., M.I.E.E.
A. Dickinson, M.I.C.E., M.I.E.E., M.I.M.E.
H. Justus Eck, M A, M I.E.E.
W. B. Esson, M.I.C.E., M.I.E.E.
E. H. Freeman, A.I.E.E.
E. Garcke, M.I.E.E.
J. Barber Glenn
F. E. Gripper, M.I.E.E.
H. Hirst, M.I E E.
J. G. Lorrain, M.I.E.E., M.I.M.E.
J. A. Lycett, J P.
W. C. Mountain, M.I.E.E., M.I.M.E.
R. K. Morcom, M A., A.M.I.E.E.
W. M. Murphy, J.P.
H. B. Renwick, A.I.E.E.
A. A. Campbell Swinton, M.I.E.E, M.I.C.E.
A. P. Wood, M I E.E.

R. Borlase Matthews, A.M.I.C.E., *Hon. Sec.*

Bank Buildings, Kingsway,
London, W.C., *March*, 1910.

[Names printed in italics did not appear on the provisional Committee of the former Electrical League.—Eds. E.R.]

SOUTHPORT ELECTRICITY WORKS EXPLOSION: RESUMED INQUEST.

On Tuesday, March 8th, Mr. Coroner S. Brighouse resumed the inquiry at Southport into the circumstances attending the death of William Saunders, who was killed at the Corporation electricity works on November 12th last. Mr. J. E. Jarret (Town Clerk) represented the Corporation, and others present included Councillor R. Morrin, the chairman of the Electricity Committee, and Mr. A. E. Davis, public analyst.

Mrs. Saunders, the widow, said she was a certificated nurse residing at Brick Kiln, Banks. Her husband, who was 39 years of age, was an engine driver at the Corporation electricity works. On November 12th he told her he was going to drive No. 5 engine, which had recently been repaired. She asked him if it had had a new cylinder put in, and he replied, "I don't know whether it has or not, but most probably it has bands put round." About a week previously her husband had discovered "knocking" in this engine, and reported it to the foreman, whereupon packing was put round the cylinder. About 9 o'clock on the day mentioned, she received a message to go to the infirmary, and on arrival found her husband in a dying condition, and suffering great agony. She remained with him till 3 a.m. the next day, when he expired. He told her the engine was running hot, and he had had to stop it. The oil they used was new, and had never been used in this engine before, and they had no right to use it. In his opinion, it was the oil which caused the explosion.

John Hesketh, of 59, Poulton Road, said he was employed at the engine room, and this was the first time this particular oil had been used on No. 5 engine. They put two barrels full in the crank chamber after it had been cleaned with a paraffin rag. He and deceased noticed that it smelt "petrolly." Saunders said the packing was all right, but he did not like the way the engine was running. Witness also thought it was getting too hot, as he had never known the engine get hot before. Saunders went to the back of the engine and found vapour coming out of the manhole in the crank chamber. There was no covering on the manhole, and witness suggested that they should take over the running from No. 5 to No. 4 engine, and signal to the switchboard attendant accordingly. They then ran to No. 4, and when the load was put on they signalled to have No. 5 engine stopped. Witness shut off the steam. At this time Saunders was under the No. 4 governor and the regulator. As witness turned off the cylinder lubricator the accident took place. It seemed to originate in the small manhole. The next thing was that witness found himself on fire. There was a lot of smoke about, and the engine also seemed to be on fire. He ran away and took off his burning jacket to beat away the flames. Returning, he saw Saunders lying on the floor between the two engines. He was in flames, and witness went into the cloak room for some cloths to stamp them out.

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Saunders said to witness, "I am done this time." The ambulance was called and Saunders was taken away. Witness went and turned off the condenser of No. 5, and several officials then came up. He was subsequently taken to the infirmary himself.

In reply to the Coroner, Witness said he thought the accident was due to the fact of the oil getting hot stopping the out pressure, and consequently all the parts of the engine were not cool.

The Town Clerk: You had two warnings that something was wrong?—Yes.

The foreman said the jury wished to express their admiration for Hesketh's courageous conduct, and suggested to the Coroner that the facts of the case ought to be brought to the notice of the Royal Humane Society, as Hesketh had acted like a hero.

The Town Clerk associated himself with these remarks, and said Hesketh had been a faithful servant for the past 15 years, and in this instance had acted as would be expected of a true-born Englishman under the most trying possible circumstances.

Richard Seddon, stoker, said he noticed the pressure going down, and immediately afterwards heard an explosion in the engine room, and saw the flash from the alternator. Hesketh's head, back and shoulders were burning, and he put the flames out with his cap. A man named Hatch was just behind, and he and witness got an extinguisher and played on Saunders. He was moaning, "Put me out." Saunders said to witness, "I am finished, Dick." He was naked, his clothes having been charred to bits.

P. E. Heald, one of the engineers-in-charge at the works, said he could form no theory as to the cause of the explosion.

The Coroner: You are an engineer-in-charge, and yet you know nothing. How do you expect the jury and myself to deal with it if you cannot give us any information?

Mr. Evans, who has been works superintendent for 15 years, said it was a very difficult matter to say which was the cause of the accident. The oil, no doubt, became ignited, but why, he could not say, because parts of the machinery furthest away were lubricated, though the lower part of the engine was not. His theory was that, unwittingly, a piece of grit or dirt, or solidified oil, had got into the pipes of the engine along which the oil flowed. It pointed to something of the sort, as all the other parts of the engine after the explosion were found to be lubricated. The witness added that some vapours from the oil might have come into contact with one or two sparks, which, of course, would cause the explosion. The No. 5 engine was not found out of repair. The knocking referred to by Mrs. Saunders had been attended to.

Mr. S. Jones, a representative of the makers of the engine, said his firm had made 4,500 engines of the same type in the last 20 years, and never had an explosion reported. The oil pressure might have been too low to thoroughly lubricate the higher portions of the engine, and this would cause certain portions to become heated, and swell out. The guides would then cease to work if the oil used was of a lower viscosity than oils previously used. That would account for the loss of the pressure.

The Coroner: The lowness of the oil pressure, then, is the cause of the mischief?

Witness: Yes, certainly.

The Foreman: Do you think a difference in the quality of the oil would have a tendency to cause the explosion?—I think that difference in the viscosity of the oil has had something to do with the explosion.

Mr. Davis, borough analyst, who analysed all oil used, said they were all good, safe engine oils, and contained nothing likely to cause an explosion. The explosion undoubtedly was caused by the ignition of the oil vapour.

Mr. Black, the borough electrical engineer, said he would not hesitate to use the oil again, and produced documents to show it was of the highest quality.

The Coroner said the only fact proved by the evidence was that the accident was caused by the ignition of oil vapour.

The jury returned a verdict of "Accidental Death," and announced that in their opinion no blame attached to anyone.

BUSINESS NOTES.

Consular Notes.—Canada.—The Belgian Consul in Canada reports that according to the statistics published by the Canadian Customs, the imports of electrical machines and apparatus into Canada during the year ended March 31st, 1909, amounted to about $2,073,151. This total is made up as follows: Electric carbons, $45,517; incandescent lamp globes, $60,123; electric apparatus, electric batteries, telegraph and telephone apparatus, $1,643,696; electric motors, generators, dynamos, &c., $333,503. The following are the amounts of the imports from the various countries concerned: United States, $1,937,371; Great Britain, $91,092; Germany, $20,444; Austria, $10,693; France, $6,553; Norway, $4,486; Sweden, $1,757; Holland, $265; Belgium $225. These figures show, what our readers are well aware of already, that the greatest part of the trade is in the hands of United States manufacturers, whose close proximity to the market give them a considerable advantage. According to the figures of the last industrial census, there were in Canada 34 electrical construction firms and 157 electric lighting and power works. The total capital invested in the industry is $94,793,111, and the value of the annual production $16,584,805. The number of hands employed is 6,060. In 1901 there were only 83 works, with a total capital of $17,158,422 employing 2,821 hands. The electrical industry of Canada has thus made rapid progress during recent years. It appears that of the 95,682,907 H.P. representing the total natural water-power of the Dominion, only 516,885 H.P. is actually being used. The principal firms in Canada constructing electrical apparatus are:—The Canadian Westinghouse Co., of Hamilton, Ontario (branch of the Westinghouse Manufacturing Co., of the United States), with a capital of $3,000,000; the Canadian General Electric Co., at Peterborough, Ontario, with a capital of $2,500,000; and the Allis-Chalmers-Bullock Co., of Montreal, with a capital of $1,000,000. The number of works distributing electrical energy is so large that one must confine oneself to the largest. The reports of the Hydro-Electric Power Commission of Toronto give very exhaustive information on the subject. Amongst the principal works may be mentioned the Ontario Power Co., 50,000 H.P.; the Canadian Niagara Power Co., 40,000 H.P.; the Electrical Development Co., of Ontario, Ltd., 37,500 H.P. The first two companies have constructed their works in such a way that in the future 180,000 H.P. and 100,000 H.P. respectively may be produced. On the other hand, the works of the Toronto Niagara Power Co., now in course of construction, will be capable of supplying 125,000 H.P. Electric lighting is extensively used in the Dominion, and it is only the small towns that do not possess electric street lighting. The report of the Department of Internal Revenue for 1908-9 contains a complete list of lighting companies, amongst which the following may be noticed: Montreal Light, Heat & Power Co., 491,923 lamps; Pentanguishene and Midland Electric Street Railway, Light & Power Co., Ltd., 266,500 lamps; British Columbia Electric Railway Co., Ltd., Vancouver, 202,100 lamps; Ottawa Electric Co., 181,054 lamps; Winnipeg Electric Railway Co., 153,753 lamps; Hamilton Electric Light and Power Co., Ltd., 112,500 lamps. The length of electric car lines on June 30th, 1908, was 992 miles, representing a capital of $87,903,231. The net receipts were $5,311,169 or 6·04 per cent. of the capital invested. The number of passengers carried was 299,099,309, and the freight transport amounted to 732,425 tons. The total number of employés was 9,954, with salaries amounting to $5,757,578. There are actually 50 Canadian electric railways and tramways, of which the most important are: The Montreal Street Car Co., capital $13,420,000; Toronto Street Car Co., $11,998,326; Winnipeg Street Car Co., $10,996,894; British Columbia Elec. Ry. Co., $10,124,876; Quebec Railway, Light & Power Co., $5,402,945; the Toronto York Radial, $3,520,000; the Hamilton Radial Co., $2,271,150; Cape Breton Railway Co., $2,124,000; Montreal Park Island Co., $2,060,900. The utilisation of electricity in mine exploitation will give a new impetus to the electrical industry in Canada, where the presence of numerous waterfalls will allow of the working of mines whose value up to the present has been neutralised by their distance from coalfields. There seems to be no doubt but that with an effort electrical machinery would find a good sale in Canada, but two factors are extremely important, viz., prompt delivery and relatively long credits. Dynamos are dutiable under No. 453 of the Tariff, the rate for British goods being 15 per cent. and that for foreign goods 27½ per cent. In 1908 9 the imports amounted to $333,503, of which the United States supplied $310,490, Great Britain $18,221, and Norway $4,486. These figures show clearly the preponderance on the market of American machines of this class. United States manufacturers, owing to their close proximity to the market, carry on an active trade, and are in a position to deliver at very short notice. Moreover, American manufacturers grant to their customers credits which sometimes last from two to three years. In face of a competition so keen, it is evident that great sacrifice is necessary if it is desired to obtain a footing in the market. The employment of capable and experienced agents on the spot is the only means of securing trade in this class of goods. Small accumulators might find an opening on the market. The trade statistics include these goods amongst insulators and telegraph and telephone instruments. The amount of such imports in 1908-9 was $1,643,696, of which United States supplied $1,560,662; Great Britain, $69,887; France, $5,653; Germany, $4,100; Austria, $1,699; and Sweden, $1,465. Accumulators are subject to the same duty as dynamos. Electric carbons are dutiable under No. 316 of the Tariff, the rate for British goods being 22½ per cent. *ad valorem*, and that for foreign goods 35 per cent. *ad valorem*. The imports in 1908-9 were valued at $45 517, of which the United States supplied $24,180; Germany, $15,391; Great Britain, $2,630; Austria, $2,213; France, $338; and Holland, $265. The selling price of electric carbons in Canada is $23 per 1,000. Incandescent electric lamps are dutiable under No. 435 of the Tariff, the rate for British goods being 20 per cent., and that for foreign goods 30 per cent. *ad valorem*. The statistics do not show separately the imports of these goods, and it is not possible to determine what they amount to. The price is from 12 to 15 cents each. Arc lamps are dutiable at the same rates as incandescent lamps. It is not possible to say what is the amount of the imports, as the goods are not separately shown in the returns. Electric machinery for use in mines is admitted free of duty. As regards the production of raw materials for the electrical trade, Canada exported during 1908-9 $6,406,528 worth of copper, of which $6,212,597 worth went to the United States, and $193,930 worth to Great Britain. The exports of lead in the same year amounted to $380,381, of which $163,262 went to Japan, $133,307 to China, $75,880 to British Possessions, $5,329 to the United States, and $1,505 to Belgium. The exports of asbestos were valued at $1,757,648, and

those of iron ore at $71,663; these were principally exported to United States and Great Britain. In order to take advantage of the opportunities existing in Canada for products of the electro-technical industry, exporters should appoint experienced and reliable agents who could compete for the orders now given to American and Canadian houses, they should grant to buyers long credits of a year or even more if necessary, and they should guarantee speedy delivery in order to neutralise as much as possible the natural advantages of proximity to the market held by American firms. If this is done there is no reason why manufacturers should not find Canada a profitable market for their goods.

For Sale.—The business of Middleton & Co., electrical constructional engineers, Dover, is being offered for sale as a going concern by private treaty. Particulars appear in our advertisement pages.

The business of Platt & Bleasdale, electrical engineers, Bolton, (in bankruptcy), is being offered for sale by private treaty. See our advertisement pages for particulars.

Messrs. Percy Huddleston & Co. will, on March 21st, offer certain electrical apparatus for sale by auction at Hammersmith, as announced in our advertisement pages.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, E.C.—New Osram price list, giving revised particulars of the wattages and candle-powers of Osram lamps, which can be supplied for 17 watts, 100-135 volts; 32, 40 and 55 watts for 200-260 volts; and from 100 to 1,000 watts for 100-260 volts, besides various low-voltage and other ranges. The 600 and 1,000-watt sizes, which are fitted with special caps, measure respectively 235 mm. × 200 mm. diameter, and 350 mm. × 240 mm. diameter; they are, we should think, not far from the limit!

Mr. H. I. Lewenz, 6, Trinity Square, London, E.C.—Four-page leaflet containing several illustrations of Keiser & Schmidt's indicating and recording pyrometers for all temperatures up to 1,600°, and a list of prices of same.

The Franco-British Electrical Co., Ltd., 50, Oxford Street, London, W.—Pamphlet giving illustrated particulars of their "Franco" electric signs and strip, and a list of some prominent users of the same in London. The signs are made up of oak letters fitted with patent miniature holders connected up on a special principle. The letters are illuminated with 1-c.p. lamps spaced at from 2-in. to 3-in. centres. The lamps do not burn in simple series, so that the failure of one lamp does not mean the extinction of all. As the lamps are small and close together, it is claimed that the whole face of the letter is illuminated. The illustrations include one of a sign in Leicester Square having 720 lamps.

Messrs. McClure & Whitfield, Mersey Dynamo Works, Adswood, Stockport.—We have just received from the firm, as in previous years, one of their neat and handy self-opening pocket diaries and note-books for 1910, with pencil back and elastic band. Illustrations and specification particulars of the "Mersey" multipolar generators and motors precede the calendar, diary, and general information sections.

Taking happy advantage of the appearing of Lady Beerbohm Tree at the Vaudeville in a dramatic playlet "The Sirocco," Messrs. Davidson & Co., Ltd., of Belfast, have issued a neat card representing (by permission) her ladyship in one of the well-known "Sirocco" fans, which are inseparable from their name.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—28-page pamphlet (No. 13A) wherein appears a full description accompanied with a number of half-tone views, of their A.C. generators, which are manufactured in the usual types, and for pressures of from 200 to 6,600 volts. Nine pages are occupied with tabulated particulars of sizes and outputs for standard sizes suitable for three ranges of voltages, both in 50 and 25-cycle machines. Several pages tabulate dimensions and weights.

The Foster Arc Lamp and Engineering Co., Ltd., of Worple Road, Wimbledon, S.W., have issued a Foster metallic lamp show-card measuring 11 in. × 16 in., attractively printed in about ten colours. The show-cards are available for display purposes by dealers stocking the firm's lamps. The subject of the card will no doubt appeal to the consuming public who are anxious to keep their meter record at the minimum. A collector from the electricity department stands beneath the brilliance shed by a Foster lamp in a cellar, inspecting the meter, and the following conversation ensues with the maid:—Critical sceptical collector: "Ullo! meter's 'ardly registered since last quarter!" Rapturous maid of satisfied consumer: "That's these 'ere Fosters master's gettin' now."

The Lux Candle Co., Ltd., 240, High Holborn, W.C.—Eight-page pamphlet containing full size illustrations of the "Lux" patent electric candles of which we recently gave particulars. A list of prices is given.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.—Sheet describing and pricing their type No. 140 ironclad distributing boards.

Diamond Coal-Cutter Coal Co., Wakefield.—Card giving particulars of the progress made by the Diamond coal-cutters, also of the "Ritchie" patent underground conveyor.

Western Electric Co., Ltd., Norfolk House, Victoria Embankment, W.C.—We have received a most convenient pocket diary for 12 months commencing from March, 1910. A few pages in the front are occupied with useful tables, and there is the usual insurance coupon.

Messrs. Veritys, Ltd., Hardman Street, Deansgate, Manchester.—Leaflet X 114, showing small illustrations and tabulated prices of a variety of "Aston" electric cooking and heating apparatus.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Catalogue No. 520 containing brief particulars and prices, together with a number of beautifully clear illustrations, printed on special art paper, of protective devices for telephone installations. The various designs of lightning arresters and fuses listed are the outcome of many years' experience. The catalogue is arranged in the form of single sheets, so fastened that new sheets may be added from time to time as issued. The protective devices shown are for central station switchboards and for subscribers' telephone stations, the other contents covering cases, e.i. junction boxes, and accessories for these devices, pliers, vacuum arresters, tubular and line and safety fuses, and spare parts.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.—Three leaflets describing respectively the "Colonial" steam engine, metallic stuffing boxes, and the "direct-current steam engine."

Messrs. Vortex Pulley and Belting Co., Tower Royal, E.C.—Leaflet announcing reduced prices of "B. B." wood-split pulleys.

Sun Electrical Co., Ltd, 118,120, Charing Cross Road, W.C.—Leaflet explaining the advantages of the "Buckle Clip," used for fixing Kalkos and other electric lighting conductors, multiple telephone cables, &c. Several new sizes have been introduced, giving a complete range for wires and tubes from $\frac{5}{32}$ to $\frac{2}{3}$ in. in diameter.

Private Meeting.—Electric Ignition Co., Ltd., Birmingham.—The creditors interested in this matter were called together recently, when an approximate statement of affairs prepared on the basis of a going concern was presented. This disclosed liabilities of £3,028 due to unsecured creditors, while the London, City and Midland Bank were scheduled for £953. There was a contingent liability of £898, which was also included in the ranking liabilities. With regard to the assets, these were estimated at £10,492, less £225 for preference claims, leaving a balance of £10,267. From this amount had to be deducted an amount of £5,129 owing on debentures, and the net assets were thus reduced to £5,137, and the estate thus showed a surplus as regarded creditors of £262. The assets consisted of stock in trade, £4,600; stock in agents' hands, £336; cash in hand, £8; book debts, £1,397; loose tools, &c., £1,022; fixed plant and machinery, £1,895; machinery and plant at Suffolk Street, £750; fixtures and tools at Suffolk Street, £477; and unpaid calls, £8. The goodwill, &c., of the company was set down at £1,800, but this amount was not included in the assets. It was stated that the company was formed in 1905, and during the first 12 months of its existence a profit was made of a little over £1,000. In 1906 the profit increased to nearly £3,400, but in the succeeding 12 months a loss of £760 was made. In 1908 the loss increased to a trifle over £1,000, while it was estimated that during the past year the loss had been in the neighbourhood of £3,000. First debentures for £2,000 were issued to a Mr. H. Lewis in April, 1905. Second debentures for £2,000 were issued in October, 1908, to the London, City and Midland Bank to secure an overdraft. In December, 1908, 500 3rd debentures were issued to Mr. H. Lewis, and a similar number of the 3rd debentures were also issued to a Mr. P. F. Hall. With regard to the 3rd debentures, it was stated that the consideration for their issue was a cash one. It was stated by the Receiver that at the time the company was formed the prospects were bright. The chief business was in the manufacture of sparking plugs, but these had been superseded by other goods subsequently placed on the market. The result was that the trade of the company had fallen off very considerably. During the last 12 months the company had been experimenting, and had now perfected a magneto which it was thought would have a good future. The patent for this magneto was in the name of Mr. Hall (one of the directors), and not in the name of the company. It was stated that Mr. Hall was formerly in business in Suffolk Street, Birmingham, but afterward joined the board of the company, and transferred his plant and assets to the company. In respect of that transfer a sum of £898 was owing to Mr. Hall, and this amount appeared as a contingent liability. It was stated that the shareholders had held a meeting the previous day, and had passed resolutions for voluntary liquidation with Mr. H. Felton as liquidator. It was pointed out that under the Companies' (Consolidation) Act a further meeting of the creditors would be held in 14 days, when fuller particulars would be given to the creditors. One or two creditors suggested that an independent liquidator should be appointed to represent their interests, and Mr. Felton intimated that he had no objection to acting with a joint liquidator.

Dissolutions and Liquidations. — Improved Electric Supplies, Ltd.—Mr. H. Brougham, the Senior Official Receiver and Liquidator, is applying for his release. In making an announcement to this effect, he says:—

The Official Receiver stated in his observations issued on June 8th, 1907, that the Court had approved the sale by the debenture-holders of the whole of the assets to Messrs. Laing, Wharton & Cunnington, but that difficulties had arisen with regard to completion. It afterwards became necessary for the Receiver for the debenture-holders to bring an action for specific performance of contract, and judgment was obtained against the purchasers, who, however, became bankrupt, as a result of which an amount, which it was estimated would come into the Official Receiver's hands for distribution among the unsecured creditors, has not been received, and there is now no prospect of any such distribution being made.

Electric Ignition Co., Ltd.—This company is winding up voluntarily, with Mr. R. A. Felton, 131, Edmund Street, Birmingham, as liquidator.

Cowper-Coles Copper Corporation, Ltd.—This company is winding up voluntarily, with Mr. A. E. Tugwood, 82, Victoria Street, S.W., as liquidator. A meeting of creditors was to be held on March 10th.

Phosphor-Bronze Co., Ltd.—On February 24th Mr. S. P. Child, 8, Frederick's Place, Old Jewry, E.C., was appointed liquidator, with a committee of inspection.

General Electric Athletic Club.—On Saturday last a football team, representing the staff of the Witton Works of the General Electric Co., visited London to meet a team representing the head office, when a most exciting and enjoyable game was played. The match resulted in a win for the visitors by four goals to one, and the home team are to be congratulated on being able to make such a good show against their friends from the country, who have a formidable reputation. In the evening they were entertained to dinner, and wound up with a visit to a music hall, the party in all numbering 40.

Russia.—From trustworthy sources it is reported that an active inquiry exists at Kiev for electric lighting accessories. These have hitherto been supplied by Germany, but given equal quality, and satisfactory prices, a good sale of English goods might be made. The import tax on these articles is 9 roubles per pood.

South Africa.—The *British and South African Export Gazette* states that a complete electrical plant is required by the New Modderfontein Gold Mining Co., Ltd. The Cape Government are in the market for the supply of a number of electric motors. An order for a complete plant, consisting of two 13 H.P. three-phase motors, and two 140-K.V.A. single phase oil-cooled transformers, with switch panel, has been received by the Union Electric Co., Ltd., from Messrs. H. Barder & Co., Johannesburg.

Bankruptcy Proceedings.—W. G. Everingham, electrician, Ilford.—First meeting, March 16th, at 14, Bedford Row, W.C.; public examination, April 6th, at Chelmsford.

Joseph Platt and Richard Bleasdale (trading in partnership as Platt & Bleasdale), electrical engineers, Victoria Square, Bolton, Lancs.—These debtors attended at the Court House, Bolton, last week, for their adjourned public examination. The debtor, Richard Bleasdale, was questioned by the Official Receiver, who drew the debtor's attention to his answers at the previous examination, viz., that he had no liabilities apart from the partnership. Debtor replied that that was true so far as he knew then. He thought there had been a claim made since. At the close the Official Receiver applied for an adjournment, in order that Mr. Bleasdale might file a statement as to his separate estate, and this was agreed to. The examination stands adjourned.

W. S. Jenkinson, electrical engineer, Rodborough, near Stroud, Glos.—First meeting, March 12th; public examination, March 22nd, both at Gloucester.

Alan McAlpin (trading as McAlpin & Co.)., 44, Cank Street, Leicester, and at Cumbergate, Peterborough, electrical engineer.—The receiving order herein was made on the debtor's own petition, and according to the accounts filed the gross liabilities amount to £2,175, of which £2,068 is expected to rank for dividend. The net assets are £1,264, or a deficiency of £804. It appears that the debtor has been carrying on business in Leicester for about 12 years, starting with a capital of £300, advanced by his father's trustees on account of his share in the estate. Nothing is at present known as to the early history of the business, but it is certain that there has been an annual loss for the last five years. There was a stocktaking in December, 1907 (the last), and a balance-sheet was made out, bearing the date of the 31st of that month, together with a profit and loss account for the period from May 1st, 1905, to December 31st, 1907. A loss of £1,140 has been incurred in that time, and the balance-sheet shows a deficit of £1,627. Since December, 1907, the debtor has received £2,765 from the trustees of his father's estate, sufficient to leave him a surplus of £1,138, which added to the deficiency makes £1,942 lost during the last two years, and now to be accounted for. The liabilities include £812 owing to the bank which is, however, secured by certain guarantees. The assets are taken at his own valuation, and are probably over-estimated. The debtor has received the whole of his share in his father's estate. He ascribes his failure to losses on contracts through underestimating, expenses, and bad debts. The following are the creditors:—

Armorduct Manufacturing Co.	£25	Mawby, W.	£20
Bryant Trading Syndicate	28	National Telephone Co.	14
Brook, E., Ltd.	12	Newtons, Ltd.	34
Baker, W.	17	Norfolk Electrical Co.	40
Brotherton Tubes & Conduits, Ltd.	16	Parmiter, Hope & Sugden	10
Crossley Bros.	10	Richardson, H. G., & Sons	11
Collins & Co.	18	Rees Roturbo Mfg. Co.	72
Callender's Cable Co.	27	Stearn Electric Lamp Co.	46
Carryer, A. P.	11	Siemens Bros. Dynamo Works	31
E.M.F. Co.	73	Smith Bros., Ltd.	12
Grimsley & Co.	13	Sun Electrical Co.	14
Gent & Hurley	11	"Bankers"	811
General Electric Co.	25	Spindler & Wenham	15
General Accessories Co.	21	Union Cable Co.	26
Imperial Lamp Works, Ltd.	42	Veritys, Ltd.	15
Jopling, A., & Co.	67	Watts, W.	80
James Keith & Blackman Co.	14	Mason & Brown	11
Lancashire Dynamo and Motor Co., Ltd.	16	Contingent or other liabilities	88
McAlpin, K.	57	Preferential creditors—rent, &c.	84
		Rates, taxes, &c.	34

Alfred Ernest Felgate and William Storey (trading as Felgate & Storey), electrical engineers, 10, Queen Victoria Street, Reading, Berks.—In the above matter, particulars of which have already appeared, the deficiency is ascribed to bad trade, heavy rent, and loss at Oxford through default of an employé. It appears that private meetings of creditors were held in January last, at the second of which meetings a composition of 5s. in the £ was offered, or a deed of assignment. The debtors state that one or two firms of creditors would not consent to either arrangement. The Sheriff was in possession at the date of the receiving order, and the debtors were being sued. In December of last year the debtors handed a petrol engine and dynamo (cost £47) to creditors as part security for their debt, the debtors being credited to the extent of £20 for it. The unsecured indebtedness included £1,168, money lent by friends and relatives, and £115 in respect of balance o rent, the remainder being in respect of trade debts. The partly secured creditors hold two policies on the life of A. E. Felgate for £100 each. The books of account kept comprise cash book, petty cash books, day books, and bought and sold ledgers, but the debtors admit that these books do not contain a capital account, trading account, or profit and loss account. They further admit that they became aware of their inability to meet their engagements in December of last year.

Asiatic Turkey.—American Consul Simpich, of Bagdad, in the course of a long report, remarks that an electric lighting system for Bagdad is badly needed, and the city authorities have been seeking information on the subject. An Advisory Board was recently appointed to investigate and recommend plans for securing such public facilities as water works, lighting, &c. It is stated that over 100 oil engines are in use in the Vilayet of Bagdad, running on irrigation pumps or small flour mills. "Nearly all of them are of British make, because an English firm sent out sample engines and worked up a trade."

Home Exhibition.—There is to be an "Ideal Home" Exhibition at Olympia from April 8th to 23rd. We have no information to show how far the Exhibition will be electrical in character, but we know how far it ought to be if it is to properly fulfil its description.

Trade Announcements.—Messrs. Mawdsley's, Ltd., of Dursley, Glos., have appointed Mr. G. B. Lowe, of Warrington, to represent them in the Manchester district, comprising Lancashire, North Wales, Derbyshire, the Potteries, and South Yorkshire. Further, owing to Mr. C. E. Lugard, the firm's late representative on the North-East Coast, having left the district, Messrs. George Craggs & Co., of Albert Buildings, Middlesbrough, now represent them.

Messrs. G. Massiot Browne & Co., of Argyle Street, Glasgow, are removing to larger and more central premises, at 10, Jamaica Row, Glasgow, and they will be glad to receive catalogues of lighting, heating and power apparatus.

Messrs. J. B. Marr & Co., Ltd., 53, Victoria Street, London, S.W., desire to receive catalogues from the electrical trade.

LIGHTING and POWER NOTES.

Acton.—The U.D.C. is now experimenting with metal-filament lanterns for street lighting. Several experimental posts have been erected, and each lantern is provided with three 100-C.P. Osram lamps backed with a suitable reflector.

Argyllshire.—It is officially reported in Glasgow that an extensive scheme for the electrification of the Ballachulish Slate Quarries, in Argyllshire, is in contemplation. The work, which is an extensive one, embraces the whole of the pumping and haulage operations, and is the first instance of electricity being applied to slate quarry working in Scotland. The whole of the plant and machinery is expected to be in full working order in about three months' time.

Barrow.—At the monthly meeting of the T.C. on Monday, some discussion took place regarding a deficit of £440 on the electricity undertaking. Alderman Ashburner said the Council was asked to make good that debit balance out of the borough fund. Alderman Smith (chairman of Electricity Committee) said the custom had been to defray their deficits out of the future profits. Owing to bad trade and other reasons, they had a deficit of £440 this year, and under a new order of the L.G.B., they were prevented from carrying that forward. The prospects for next year were much improved, and the Committee would have been able to clear off the deficiency without coming to the Council for the money.

Beckenham.—At a recent meeting of the U.D.C., Mr. A. H. Dykes, the retiring chairman of the Electricity Committee, summarised the position of the department as regards free wiring, he being firmly persuaded that an alteration was necessary in the Council's free wiring scheme. A recent memorandum prepared by the clerk showed an expenditure of 23s. 3d. per free-wired lamp installed, and they had £22,613 locked up in this way. Rentals last year amounted to only £935, showing a deficit, after meeting interest and sinking fund charge of £1,708, or, roughly, 1·7d. on each unit sold to free wirers. Thus, while the private consumer paid 5d. per unit, the free wirer, after deducting the rental loss, only paid 3·3d. Mr. Dykes proceeded to show that Beckenham was obtaining a high average price per unit (4·9d.), and that the cost per point for free-wired installations was much above the average (quoting Ipswich, with 15s. to 16s. per point, and a rental of 2s. 4d. per annum), and affirmed that unless the free-wired consumer was prepared to guarantee at least the actual amount he cost the station, they were not justified in spending public money in wiring his house.

Belfast.—The Poor Law Guardians have adopted the recommendation of the Sanatorium Committee for the erection of power and accumulator houses at the Whiteabbey Sanatorium. The erection of the houses is estimated at £1,160 and the installation of plant at £4,143.

Brighton.—By 21 votes to 10 the T.C., on March 3rd, rejected the recommendation of the Lighting Committee to adopt a scheme for the mutual hire-purchase of electrical wiring and fittings between contractors and owners and tenants of small property. Under the scheme the consumer was to pay an extra 1d. per unit for electricity to meet the cost of wiring.

British Columbia.—New street lighting is under consideration in Vancouver to replace the present arc lighting suspended from wooden poles. The proposal embraces three sections each of 100 iron columns, each carrying five tungsten bulbs at about 18 ft. above the street level and spaced 100 ft. apart. The B C. Electric Co. has tentatively offered to supply energy at $6,000 per annum per section. An order has been placed with Allis-Chalmers-Bullock, Ltd., for two 60-cycle three-phase 2,000-KW. turbo-generators and two 50-H.P. motors for the condensing plant for the B.C. Electric Railway Co.'s auxiliary steam station in Vancouver.

Canada.—The Shawinigan Water and Power Co. has recently placed the following orders for new equipment:—Canadian General Electric Co., two 2,220-KW., three-phase, 50,000-volt transformers, for installation in its transformer station at Shawinigan Falls, and one 2,000-KW. three-phase transformer for installation at the south cable house, Three Rivers, Que.; Canadian Westinghouse Co., one 3,000-KW. three-phase transformer for the north cable house, Three Rivers, Que.; one 4,000-KW. three-phase transformer for installation in the Montreal terminal sub-station, and one 3,000-KW. generator for its Shawinigan power house. An 8,000-KW. Westinghouse generator, direct connected to an I. P. Morris horizontal turbine, was recently tested and placed in operation in the Shawinigan Falls power house. The company has under construction a new transmission line between Three Rivers and Nicolet, Que., a distance of nearly 25 miles.

Canterbury.—At a meeting of the T.C. on March 2nd a motion to rescind a resolution supporting the Maidstone and other T.C.'s in promoting a Bill empowering corporations to supply lamps and to undertake the wiring of premises, was rejected. It was urged that the powers sought would interfere with private traders, but it was explained that the T.C. had to compete with a powerful gas company, and must show what could be done with electrical appliances.

Clacton-on-Sea.—The U.D.C. has, by 7 votes to 5, decided not to install producer gas plant at the electricity works. The estimated cost was £840.

Continental.—FRANCE.—A fire which occurred at the Thomson-Houston Co.'s power house at Port à l'Anglais, Paris, and lasted three hours, caused damage estimated at £30,000. The power house was destroyed, and as a result the tramways of the Eastern Co. and the Bastille were brought to a standstill.

Darlington.—At a meeting of the T.C. on the 3rd inst., Mr. Wooler, in moving the adoption of the Electric Lighting and Tramways Committee's report, said that they had recommended that energy supplied to the light railway department should be reduced from 1½d. per unit to 1d., which would effect a saving of £230. They were able to make that reduction owing to the economies effected in the works. As to street lighting, he mentioned that they had tried 12 varieties of flame arc lamps, and at the next meeting they would make a recommendation that the two they considered best should be accepted.

Dundee.—The Electricity Committee recommends that insurance to the extent of £40,000 be effected on the new generating station, and to the extent of £10,000 on the sub-stations.

Exeter.—The question of the general rewiring of the electric light installation at the City Asylum, has been engaging the attention of the Committee for over a year past; the resident engineer has, upon the instruction of the Committee, prepared a scheme for this, which is now under consideration.

Farnham.—The Board of Trade has revoked the 1905 electric light order.

Fife.—The contractors for the naval base at Rosyth (Messrs. Easton Gibb & Sons, Ltd.) have recently introduced several electric cranes. The last of the four suction gas engines for driving the generators is being erected, and when complete the contractors will be able to generate 1,000 H.P. It is expected that as operations develop, another 1,000 H.P. will be required.

Finchley.—Application is to be made to the L.G.B. for sanction to borrow £10,000 for mains extensions, &c., to March 31st, 1912. The total is made up as follows:—Mains, £2,234; connections, £6,660; meters, £1,000; charges, £106. It was mentioned that the gross revenue of the undertaking in 1905 was £3,833; in 1906, £7,261; in 1907, £9,381; in 1908, £11,324; in 1909, £13,174; and up to December 31st last it was £10,186. It was estimated that £4,600 or £4,700 would be added to the last amount by the end of the financial year. With regard to capital, they had paid off £2,236 in 1907, £2,961 in 1908, £3,507 in 1909, and (estimated) £4,560 in 1910.

Frimley (Camberley).—Acting on the recommendation of the Committee appointed to consider the question of electric lighting, the U.D.C. has decided to proceed no further in the matter of applying for the necessary powers. The local gas company will, therefore proceed with its proposed undertaking.

Gillingham (Kent).—The T.C. has received from the L.G.B. sanction to loans of £1,900 for electrical purposes.

Haulbowline (County Cork).—It is announced that a further extension of the electrical installation is contemplated at the Royal Naval Yard, including electric power for working the capstans at the new dock and the lighting of the dockyard offices.

Hereford.—The T.C. has decided to apply to the L.G.B. for loans of £1,500 for new mains and £1,500 for services.

The R.D.C. has given consent for the T.C. to supply electricity to consumers in the parish of Breinton. The B. of T. is to be applied to for an order permitting the supply under the new E.L. Act.

Liverpool.—Electricity as a lighting medium had a splendid testimonial at the meeting of the Corporation on Wednesday, March 2nd. Replying to a question as to the cost of lighting Hardman Street with electricity, Sir Chas. Petrie said the cost would be £250, and the annual additional sum for maintenance would be £49. At the present time the gas lighting of the street gave 2,460 C.P., while, with the new lighting, there would be 10,000 C.P. Some time ago, when electric light standards were put up in Leece Street, the tradespeople were so satisfied that the Committee had a petition from the neighbouring street for similar treatment.

London.—WOOLWICH.—It has been decided to offer a contract system of charging to long-hour consumers, based upon their normal maximum demands, to be ascertained by the borough electrical engineer. The quantity of energy being ascertained, and the price of supply agreed upon, the contract will provide that an adjustment of the account for energy, shall be made at the end of the fourth quarter in each year during which a supply is taken, and in the event of the consumption being in excess of, or less than that agreed upon, the difference, within a limit of 10 per cent., shall be charged for or allowed for at the rates specified. The scale of charges will be as follows: 3 hours per day, 2·84d per unit; 4 hours, 2·40d.; 5 hours, 2·10d.; 6 hours, 1·90d.; 7 hours, 1·60d.; 8 hours, 1·70d. The scale of allowances is fixed thus: (1) Every consumer contracting for one year for a definite supply for three hours per day and over, 5 per cent. allowed off the normal maximum demand; (2) for two years' contract, 10 per cent. to be allowed; (3) for three years' contract, 15 per cent.; (4) for four years' contract and over, 20 per cent.

The annual report of the Finance Committee of the L.C.C. for the year ended March 31st, 1909, states that during the year the Committee has again had under consideration the question of the necessity for the establishment of funds for renewals by the borough councils in connection with their electric lighting undertakings, and of the adequacy of such funds, where the same have been created. The financial position of the undertakings of some of the borough councils appears in this respect to be unsatisfactory, and every opportunity has been taken of urging upon those borough councils who possess no reserve funds, or whose reserve funds appear to be inadequate, the necessity either for creating or strengthening such funds or for reducing the repayment period of the 42 years' loans, which are in respect of mains, plant, machinery and house connections.

HAMMERSMITH.—We understand that 550 of the street lamps have been converted from gas to electric lighting, using 100-watt Osram lamps; in addition, the Grove is now lighted by 400-C.P. Osram lamps, particulars in regard to which have already appeared in these notes.

Macclesfield.—It was announced at a meeting of the T.C. on March 2nd that the Board of Trade had intimated that the E.L order was to be revoked forthwith. It will be remembered that recently the T.C. decided against a recommendation to take steps towards carrying out the order, it being considered that there was not a sufficient demand for current to justify the carrying out of a scheme.

Monmouth.—The T.C. is endeavouring to come to terms with a London firm to take over the electricity works of the borough, and supply the town with electric light.

Partick.—On Thursday, March 3rd, the extensions made in the electricity station of the T.C. were opened by ex-Bailie Jackson, the convener of the Electricity Committee. The electricity and destructor works were erected in 1902, and on several occasions since new plant has been installed and extensions effected. The latest additions include a 1,000-KW. generator, direct coupled to a high-speed engine, with surface-condensing plant, water-cooling tower, Stirling water-tube boiler, &c. The total cost of the extensions amounted to £21,328. The capital expenditure on the electricity works up to May last was £122,082, of which sum £10,252 has been repaid. The sinking fund amounts to £4,567, and out of the profits a sum of £5,715 has been set aside as a reserve fund.

Penmaenmawr.—The U.D.C. has instructed the surveyor to prepare a scheme of public lighting by means of 100-C.P. metal-filament lamps. Experiments have been carried out, energy being supplied from the private power station of Messrs. Darbishire.

Ravensthorpe.—Messrs. Marshall, Kaye & Marshall recently had a breakdown of the main driving engine at one of their Ravensthorpe mills, bringing the whole of the machinery to a standstill, consisting of nearly 400 H.P. In less than 10 days, by the aid of the Yorkshire Electric Power Co., electric motors were fixed and the machinery restarted. A stoppage of, perhaps, five to six months would have been occasioned while the necessary repairs were being effected to the engine.

St. Helens.—The boiler plant at the electricity works is to be extended, and underfeed stokers are to be installed, at an estimated cost of £3,090.

Salford.—Last week the T.C. was asked to say that in future users of electricity for power should be allowed to use current for lighting at the power rate up to 10 per cent. per quarter of their consumption, instead of 15 per cent., as at present. Mr. Billington, the chairman of the Electricity Committee, said they were losing money through the adoption of the metal-filament lamps, and the change recommended would make a difference to them of £500 a year. The abolition of the whole 15 per cent. would mean a difference to them of £2,500. The recommendation was approved.

Southport.—With a view to effecting economies, it is proposed to merge the tramways and electricity estates of the Southport Corporation into one undertaking.

Stretford.—The resident engineer is to report upon the plant installed at the station with reference to the question of further extensions, and the architect is to prepare a report with regard to the stability of the buildings in respect of vibration.

Swindon.—The T.C. has decided that in future a commission of 10 per cent. shall be charged on the sale of motors instead of 5 per cent. as heretofore; and that in cases where the wiring of consumers' premises has been carried out under the assisted wiring scheme, and the consumer decides to purchase the installation outright, a commission of 2½ per cent. shall be charged.

Tavistock.—The U.D.C. is considering the question of electric lighting. Messrs. Rudge & Co. have sought the consent of the Council to an application for a prov. order, but as Mr. E. C. Spooner, a member who advocates a municipal scheme, is obtaining a report at his own expense as to the probable cost of a scheme, the U.D.C. has deferred its consent to Messrs. Rudge & Co.'s application.

West Hartlepool.—The T.C. has been informed that the B. of T. has authorised the Cleveland and Durham Electric Power Co. to supply energy to the Tramway Co. The Council had opposed the granting of such a privilege.

Whitby.—The U.D.C. has decided that existing consumers above the six-light scale shall be supplied in future on the present existing rate for all purposes, viz.:—£15 per annum per KW. demanded, plus 1d. per unit. The contract demand system, however, is to be pushed before customers, and its advantages demonstrated. For heating and cooking the standing scale of charges is to be, ¼ KW., 5s.; ½ KW., 10s.; ¾ KW., 15s.; 1 KW., £1; 2 KW., £1 10s.; 3 KW., £1 15s.; 4 KW., £2; 5 KW., £2 2s.; or a flat rate of 5d. per unit, less the usual discoun', with a minimum return of 13s. 4d. per quarter.

Whitley Upper.—The U.D.C. has asked the Yorkshire Electric Power Co. to submit terms for a supply of electricity in bulk for lighting purposes.

Wigan.—Mr. R. H. Hooper, on behalf of the L.G.B., held an inquiry on March 7th relative to the Corporation's application for sanction to borrow £36,000 for electricity works extension. The scheme is to transform the Pemberton generating into a sub-station, and to generate electricity at the central station in Wigan. The total production at the Wigan station was 2,970,317 units, at a cost of £11,545, which worked out at 0·932d. a unit; while the figures for Pemberton were 772,866 units at a cost of 1·368d. per unit. It is estimated that under the new scheme there will be a saving on works cost of £2,667. Evidence was also given that, in present circumstances, the generating plant was taxed almost to the utmost, and that there were applications from the adjacent industrial town of Ince for 223,000 units for power and 2,000,000 units for lighting, which the Corporation was not in a position to supply now.

Wimbledon.—Messrs. Carter & Co., who are building a seed factory at West Barnes Lane, Merton, are negotiating with the Council for a supply of energy for lighting and power purposes. The Council offers a supply at 1½d. per unit, conditional upon not less than 20,000 units per annum being consumed.

Wrexham. — The County School Governors have requested the borough electrical engineer (Mr. Pickvance) to submit a rough estimate of the cost of installing the electric light throughout the schools.

Yarmouth.—The T.C. on Tuesday considered a report from the borough surveyor on the subject of substituting electricity for the remainder of the gas lamps in the borough. The surveyor stated that gas lamps in Yarmouth cost £3 6s. 8d., and Gorleston £3 10s. per lamp, while in future electric lamps were to be charged at £3 per lamp. The number of gas lamps in the borough was 673, costing £2,272 a year, while to light them with electricity would cost £2,019, a saving of £253. The sub-committee recommended that the whole of the public street gas lamps should be converted into 80-C.P. electric incandescent lamps. As the Electricity Committee had agreed to reduce the price of the existing 282 lamps from £3 3s. to £3 per lamp so soon as it was entrusted with the whole lighting of the borough, there would be a further saving of £42. The sub-committee recommended that the work should be carried out in two years, and the matter was referred to the Electricity Committee to report upon the financial proposals.

York.—A statement as to the progress of the electricity department during the nine months ending December 31st last, shows that the revenue increased by £488, with a corresponding expenditure increase of £25. Lamp connections increased by an equivalent of 3,158 C.P., and new motors equalled 77½ H.P. A traction supply is now being given to the tramways along the Fulford route, and the Osram street lamps along Fulford Road are now in use.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Suburban Tramways Co. has accepted the terms fixed at a special meeting of the T.C. for the supply of electricity from the Corporation.

Bradford.—The T.C. has decided to renew and double a portion of the tramway track, and to substitute span wire construction for centre poles, at an estimated cost of £27,057.

Burnley.—The Tramways Committee intends to consider, at an early date, the extension of the tramways, and the manager has been instructed to report to the next meeting upon the advisability of extending the line along Briercliffe Road, as far as the workhouse.

Canada.—A Bill for some amendments to the Ottawa, Kingston and Smith's Falls radial railway is now before the House of Commons, and has received its second reading. Preparations are well under way for the early construction of this electric road; when completed it will probably be the longest stretch of suburban road in Canada. It is intended to make a complete circuit of the important towns in Eastern Ontario, from Ottawa to Kingston, *vid* Smith's Fall and returning to Ottawa *via* Brockville, Cornwall, Perth, and other smaller places.

Ecuador.—According to *Electric Traction Weekly*, a Baltimore company has been incorporated with an authorised capital of $1,580,000, to build a 40-mile electric railway in order to develop the timber and fruit interests in Ecuador.

Edinburgh.—The T.C. has adopted the Tramway Committee's recommendation that in lieu of the extension of the cable tramway along the cross road between Gorgie Road and Slateford Road, an electric tramway should be constructed from Ardmillan Terrace, along Slateford Road to the new markets at Gorgie.

Halifax.—At the meeting of the T.C. on the 2nd inst., the chairman of the Tramways Committee announced that the tramways would yield a profit for the past year of £10,000—by far the largest amount they have earned in one year.

Haslingden.—The Haslingden and Rawtenstall Corporations have confirmed the main terms of an agreement for three months' trial running of electric cars between Haslingden, Rawtenstall and Accrington. The Electric Tramways Committee of Accrington has also approved of the terms embodied in the agreement, which is to be submitted to the B. of T. for confirmation.

Liverpool.—Interesting developments are about to take place in connection with the electric tramways. It is expected that during March four extensions of the system will be opened for traffic. The new sections will link up Litherland with Seaforth Station, Longmoor Lane with Fazakerley, Cabbage Hall with Club Moor, and Menlove Avenue with Calderstone Park. A new car-shed will be completed at Garston; and a first-class fare service will be inaugurated on the Crosteth Road route.

Glasgow.—Consultations have been held between the Government Assessor and representatives of the T.C.'s tramway department, regarding the basis upon which the valuation of the undertaking should be fixed. Hitherto the practice has been to allow a deduction of one-half of the amount expended or set aside for the renewal of the track or permanent way. The Assessor takes the view, it is understood, that this being a landlord's charge, the deduction should be discontinued. The proposed change in the basis of assessment would represent an increased valuation of nearly £60,000, equivalent to an additional charge against the department for taxation of about £12,000. It is probable that the point raised will be carried to the Court of Session for a decision.

Two new extensions on the T.C.'s system were opened to traffic on March 6th. The first is in Crow Road from Dumbarton Road to Clarence Drive, about ½ mile in extent. The second is on the Old Edinburgh Road, connecting Dennistoun terminus with Sartocher Road, and measures about 1 mile.

Llandudno.—The Great Orme Tramway Co. has offered to dispose of its undertaking to the U.D.C. for £7,500.

At the request of the Llandudno United Tramways Co., Ltd., the Llandudno Council has decided to take a poll of the ratepayers on the question of the Sunday running of the cars.

Rowley and Quarry Bank.—Since the announcement was made in the ELECTRICAL REVIEW that the B. of T. had granted a further extension of the Quarry Bank, Brierley Hill and Rowley Light Railway Order until July 30th, a conference of representatives of the three Councils has been held, and a resolution passed with a view to certain negotiations being entered into in the hope of means being obtained for the construction of the railway.

U.S.A.—Last week an avalanche of snow overwhelmed two Great Northern trains and four electric locomotives which were blocked by snow near the west entrance of the Cascade Tunnel, in Washington State. This section of line is operated by 6,000 volts three-phase current on the overhead system, and it is reported that the local power station which furnishes energy to the line was also swept away. Reports state that 60 lives were lost before the trains were dug out.

It is stated that the Pennsylvania Railway intends to expend about $1,000,000 on a scheme for electrifying its Cincinnati terminals and establishing a through suburban service to Lebanon. The company intends to employ electric locomotives for shunting in order to do away with the smoke nuisance.

Watford.—Inquiries have recently been made on behalf of the U.D.C., on the Continent and elsewhere, in regard to railless electric traction. The Highways Committee having considered the matter, reported at the last meeting that it was not prepared to recommend that railless electric traction be substituted for the proposed electric tramways at Watford.

Weston-super-Mare.—At a recent sitting of the Light Railway Commissioners, the applications in respect of two branch lines by the promoters of the Weston-super-Mare Junction Light Railway order were considered, and sanction was given to Railway No. 1, which proposes to link up the Weston-super-Mare, Clevedon and Portishead Light Railway with the existing line of the Weston-super-Mare Tramways Co.

TELEGRAPH and TELEPHONE NOTES.

Cable Repaired.—Perim-Obock, March 7th, 1910.

Canada.—The Provinces of British Columbia and Alberta have been linked up by the long-distance telephone system of the Alberta Government.

French Telephone Officials.—The New York Telephone Co. have agreed to take on six young telephone officials from Paris and give them a thorough practical training in all the branches of the telephone business.

Paris-Munich.—A direct telephonic line is to be established between Paris and Munich.

Postal Telegraph Factory.—At a meeting of the Engineering and Stores Association (Postal Telegraphs and Telephones) on Saturday last, a protest was made against the system of piecework and contracting-out practised under that department of the Post Office. It was stated that the Post Office was arranging for the manufacture of 10,000 wall telephone cases, and the fear was expressed that the work might be taken from the factory and given to a private firm. The question was raised in Parliament, and Mr. H. Samuel stated that he was making every effort to provide a sufficiency of work for the factory.

Telegraph Letter Service.—The Western Union Telegraph Co. has announced that it will soon institute a night letter service at a rate of one-fifth that of regular day message service, the minimum number of words to be 50. The letter messages will be transmitted between midnight and morning, and delivered through the local post office.—*Electrical World.*

Turkey.—The Turkish Government is reported to be considering the question of establishing a network of telephone lines extending from Constantinople to Jerusalem and Mecca.

Wireless Telegraphy.—A wireless telegraph installation is to be tried on steam fishing trawlers in the North Sea, with the object of enabling the fishing fleets to know the state of the markets.

The United Wireless Telegraph Co. (U.S.A.) is erecting a high-power station 8 miles from Montauk Point. Two 400-ft. towers will be erected, and the present station at Manhattan Beach will be discontinued. A similar station will probably be erected at some point on the French coast, and it is hoped that trans-Atlantic messages will be transmitted under favourable conditions. The company is also equipping a high-power station on the Pacific Coast, near San Francisco, where the towers will be 200 ft. high. The company now has its apparatus upon 260 steamships sailing from American ports. An active campaign has also been made for business in England and on the Continent. There are to-day more American ships equipped with wireless than there are British.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—March 14th. Electrical goods for a year for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman Office near Aberdare.

Australia.—Telephone switchboards for New South Wales, and poles (iron or steel) for Western Australia, for the P.M.G. See "Official Notices" February 4th.

Wire testing machine, for the P.M.G.'s department in Western Australia. See "Official Notices" February 4th.

One electrically-driven dust extractor for the P.M.G.'s Department in Queensland. See "Official Notices" February 11th.

Tasmania.—Material for accumulator equipment, for the P.M.G. See "Official Notices" March 4th.

Belgium.—March 23rd. La Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels, is inviting tenders for the contract for the supply of the electrical energy required for the local railways in the Bruges district.

April 2nd.—The municipal authorities of Ghent are inviting tenders for the supply of three electric cranes for the Ghent docks.

Bolton.—March 31st. Materials and stores for the Electricity Department. See "Official Notices" to-day.

Buenos Ayres.—We find that tenders for the 20 movable electric cranes mentioned last week, have to be lodged in Buenos Ayres by March 12th (to-morrow).

Burnley.—March 14th. Electrical goods for the Board of Guardians. J. S. Horn, clerk, Union Offices.

Cape Town.—April 6th. Installation of a system of ventilation for the additions to the Cape Town Houses of Parliament. Information from the Agent-General for Cape Colony, 100, Victoria Street, Westminster, S.W.

Carlisle.—March 14th. Two water-tube boilers, superheaters, mechanical stokers, &c., and two boiler feed pumps, for the Corporation. See "Official Notices" February 25th.

Chichester.—March 22nd. E.L. sundries for the West Sussex County Asylum for a year. J. R. Newman, clerk and steward.

Croydon.—March 14th. Electrical appliances for the B.G. Union Offices, Mayday Road, Thornton Heath.

Cuba.—March 28th. Telephone system at Santa Fé (Island of Pinos) within a radius of 10 km. Deposit 200 pesos. Tenders to Secretaria, Direccion General de Communicaciones, Gobierno Provincial, Havana.—*B. of T. Journal.*

Dudley.—March 22nd. Electrical sundries for the B.G. for six months. G. W. Coster, clerk, Union Offices.

Felixstowe and Walton.—Steel boiler drum, oil cart and set of switchgear and cable connections, for the U.D.C. See "Official Notices" March 4th.

Glasgow.—March 22nd. 20,000 car lamps, for the Corporation. See "Official Notices" March 4th.

March 29th.—Main cables, meters and arc lamp carbons for the Corporation. See "Official Notices" to-day.

Gloucester.—April 2nd. Electric lighting of the Shire Hall extensions. See "Official Notices" to-day.

Grimsby.—March 21st. 300 cast-iron lamp-posts, swan necks and D.P. fuse boxes, for the Corporation. See "Official Notices" March 4th.

Halifax.—March 22nd. Electrical fittings for six months for the B.G. A. T. Longbotham, clerk, 4, Carlton Street.

Italy.—Parma.—The T.C. has received official authorisation to invite tenders for the construction and working of several lines of electric tramways within that city.

Keighley.—March 14th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. G. E. Spencer, clerk, North Street, Keighley.

Limerick.—March 25th. Annual supplies for the B.C. Electricity Department. See "Official Notices" to-day.

London.—Battersea.—Stores for a year, for the B.C. See "Official Notices" February 18th.

March 23rd.—Wiring and fittings for the electric lighting at the Camden Street Central School. See "Official Notices" March 4th.

River Plate.—The Santa Fé municipality is about to invite tenders for tramway electrification, the concession carrying the right to supply electric light and power in the northern part of the city.—*B. of T. Journal.*

St. Helens.—March 15th. Reconstruction of about one mile of single track tramway, with passing places, &c., for the T.C. (returnable deposit of £1 1s.). G. J. C. Broom, borough engineer.

Salford.—March 28th. Motor tower wagon for the T.C. General Manager of the Tramways.

Salford.—March 31st. Electric wiring of the Wellington Street Boy's Council School, Pendleton. See "Official Notices" to-day.

Southampton.—March 14th. Twelve months' supply of stores and fittings for Electricity and Tramway Departments, Southampton Corporation. H. F. Street, Corporation Tramways Office, Above Bar Street, Southampton.

Spain.—The municipal authorities of San Baudillo de Llobregat (Province of Barcelona) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Teneriffe.—March 21st. The municipal authorities of La Luguna, Teneriffe, are inviting tenders for the concession for the public electric lighting of the town until 1954.

Tonbridge.—March 18th. Cables, meters, arc lamp carbons, &c., for the U.D.C. for a year. H. W. Peach, clerk, Tonbridge Castle.

Transvaal.—March 14th. According to the *British and South African Export Gazette*, tenders are invited by the Agent-General for the Transvaal, 72, Victoria Street, S.W., for the supply to the Posts and Telegraphs Department, of 51,000 insulators, 8,000 tubular galvanised iron arms, 10,000 eyebolts, 17,000 cup holders, 120,000 insulator spindles, 133 tons 15 cwt. of wire, 70,000 copper tapes, 70,000 copper binders, 1 ton of solder, and 144 pints of soldering solution. The Transvaal Government are about to purchase a quantity of copper and iron wire.

Warrington.—March 22nd. 1,000-KW. turbo-alternator, 750-KW. rotary converter and switchgear, for the Corporation. See "Official Notices" March 4th.

Whitchurch (near Cardiff).—March 16th. Electric light sundries for a year, for the City of Cardiff Mental Hospital. Clerk and Steward of the Hospital.

Wimbledon.—Tenders are to be invited for the installation of a fire alarm system connecting the central fire station with 19 call-points.

Wrexham.—March 15th. Stores for the T.C. See "Official Notices" February 18th.

CLOSED.

Belfast.—At the meeting of the Electrical and Tramway Committee, on the 7th inst. the tenders for the supply of a 1,500-KW. dynamo and condensing plant came under consideration, and that of Messrs. Willans & Robinson was recommended for acceptance.

Belgium.—Seven concerns submitted tenders for the establishment of a central electric lighting station in the little town of Bree (Limburg), the lowest being that of the Société de Construction et Exploitation d'Usines a Gaz et de l'Électricité, of Brussels.

Bradford.—The T.C. has accepted the tender of the National Rail and Appliances Co., Ltd., for cast-iron brake blocks, for the tramcars, at £636, and that of Messrs. E. Brooksbank & Co., Ltd., for motor grease, at £230.

Burnley.—The Board of Guardians has accepted the tender of Messrs. Carter & Co., of Nelson, for the E.L. installation at the Nurses' Home, at £194.

Burton-on-Trent.—The T.C. has accepted the following tenders for annual supplies of coal to the generating station:—

C. Spalding.—1,000 tons Moira fine slack.
Marriott & Co.—3,900 tons Netherseal fine slack.
R. B. Barrett.—2,850 tons Kingsbury fine slack.

Canterbury.—The T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for two commutating poles, at £85.

Italy.—The Italian Post and Telegraph authorities in Rome have just placed a contract with Messrs. E. Bertelli & Co., of Milan, for the supply of 100,000 metres of lead-covered double-conductor cable.

Keighley.—The Electricity Committee of the T.C. has accepted the following tenders:—

British Thomson-Houston Co., Ltd.—Two 1,000-KW. turbo-alternators and condensers, £7,308, and high-tension switchboard, £762.
Phœnix Dynamo Manufacturing Co., Ltd.—300-KW. motor-generator, £820.
Western Electric Co., Ltd.—Cables.
Albion Clay Co.—Ducts.

London.—BATTERSEA.—The T.C. has accepted the tender of Messrs. Körtings, Ltd., for an ejector condenser, valves, gauges, &c., for a turbo-generating set, at £110.

ISLINGTON.—With reference to our list of accepted tenders for the B.C. Electricity Supply Department, the offer of the British Electrical Trade Supply and Bitumen Co., Ltd., for Trinidad bitumen, was accepted.

HAMMERSMITH.—The B.C. Electricity Committee has received tenders for six 100-KW., one 200-KW., and one 250-KW. transformers as set out in the table printed below:—

On tests of comparative circuit losses, regulation and weight, the most favourable tenders received were those of the General Electric Co. (£892), British Westinghouse Co (£892), who quoted for the same machine, and the British Electric Transformer Co. (£919). In the engineer's opinion, the higher price quoted by the last-named firm was more than counterbalanced by the reduction in circuit losses and the better regulation obtained, and as the company's machines had given satisfaction in previous years, the Committee recommended the acceptance of their tender at £919.

The following tenders have been received for a 30-H.P. two-phase motor:—

British Thomson-Houston Co.	£57	Harding Churton & Co.	£64
Rhodes Motors, Ltd.	58	British Westinghouse Co.	66
Electric Construction Co. (accepted)	60	Langdon-Davies Co.	70

The tender of the City Glass Co. has been accepted for arc lamps, globes and lamp shades.

Tenders for carbons have been received as follows:—

Sloan Electrical Co.	£222	Veritys, Ltd.	£278
H. G. Mayer & Co.	242	General Electric Co.	284
Ship Carbons, Ltd.	243	W. Geipel & Co.	285
Crompton & Co.	245	Siemens Bros. Dynamo Works.	405
G. Braulik	260	Wells' Electric Co.	572
Johnson & Phillips.	267		

The Committee do not recommend the acceptance of any tender pending tests of samples submitted.

The Committee received the following tenders for cable:—

Marsh, Son & Co., Ltd. (foreign)	£76
Electrical Co., Ltd. (foreign)	77
Pirelli, Ltd. (foreign)	78
Veritys, Ltd. (foreign)	86
J. Littauer (foreign)	103
Liverpool Electric Cable Co. (accepted, subject to a guarantee that the cable is English made)	104
Yorkshire Cable Co.	110
W. Geipel & Co. (foreign)	113
Callender's Cable Co.	114
C. Mackintosh & Co., Ltd.	115
Gillespie & Beale	116
General Electric Co.	120
British Electric Manufacturing Co.	120
Berry, Skinner & Co.	139
British Westinghouse Co.	144
Johnson & Phillips	151
British Insulated and Helsby Cables	151
W. T. Glover & Co.	151
Siemens Bros. & Co.	155
Western Electric Co.	162
I. Frankenburg & Sons	170
W. T. Henley's Telegraph Works	171

Tenders for joint boxes, disconnecting boxes, &c., have been received as follows:—

Sykes & Sugden, Ltd. (not to specification)	£360
W. Lucy & Co. Ltd. (accepted)	374
W. T. Henley's Telegraph Works Co.	511
Johnson & Phillips	551
Callender's Cable Co.	587
British Insulated and Helsby Cables, Ltd.	662
W. T. Glover & Co.	1,979

Tenders for metal-filament lamps have been received as follows (whole of items on schedule):—

G. Braulik (German)	£169
Maxim Lamp Works Co.	214
Sunbeam Lamp Co.	221
British Westinghouse Electric and Mfg. Co.	231 & 242
General Electric Co.	237

For lamps up to 88 C.P. only:—

E.M.F., Ltd.	£113
G. Braulik (German)	130
Pope's Electric Lamp Co.	135
M.S. Lamp Co. (foreign)	144
"Z" Lamp Co.	149
Baxter & Caunter	149
Veritys, Ltd.	155
Sloan Electrical Co.	159
Electrical Co., Ltd. (foreign)	167
Maxim Lamp Works Co.	171
Sunbeam Lamp Co.	175
Edison & Swan Co.	177
Bryant Trading Syndicate, Ltd.	183
General Electric Co.	188
Rugby Lamp Co.	188
British Westinghouse Co.	189 & 192
Cryselco, Ltd.	242

Recommended that no tender be accepted pending tests of samples to be submitted.

The tender of the British Thomson-Houston Co. for meters has been accepted.

HAMMERSMITH TRANSFORMER TENDERS.

	Prices.				Open circuit losses.			Regulation.			Weight.			Temp. rise.	Delivery.
	6-100 KW. £	1-200 KW. £	1-250 KW. £	Total. £	100 KW. Watts.	200 KW. Watts.	250 KW. Watts.	100 KW. %	200 KW. %	250 KW. %	100 KW. Cwt.	200 KW. Cwt.	250 KW. Cwt.	Deg.	Weeks.
Johnson & Phillips	360	87	107	554	900	1,150	1,300	1·0	·8	·73	13½	21½	26	40	7
Lahmeyer Electrical Co.	520	136	163	819	860	1,500	1,750	—	—	—	15	26	30	32	8
General Electric Co.	522	172	198	892	700	1,300	1,600	1·0	·8	·8	27½	50	51	50	8
British Westinghouse Co.	522	172	198	892	700	1,300	1,600	1·0	·8	·8	28	50	54	50	8
Spagnoletti, Ltd.	588	149	170	907	510	940	1,100	1·14	1·0	1·0	33	52	60	27	8 & 15
British Electric Transformer Co.	582	159	178	919	490	1,000	1,100	·75	·6	·6	25	45	50	60	8
British Thomson-Houston Co.	582	175	185	942	490	1,000	1,100	·75	·6	·6	25	45	50	60	8
General Electric Co.	597	163	182	942	490	1,000	1,100	·75	·6	·6	25	45	50	60	8
Siemens Bros.	888	—	—	—	595	—	—	—	—	—	11½	—	—	—	11
Ferranti, Ltd.	459	—	—	—	550	—	—	1·5	—	—	28	—	—	55	6

Glasgow.—It was reported and approved at the last meeting of the Trustees of the Clyde Navigation that the following tenders had been accepted:—

Twelve series-wound and four compound-wound motors required for the capstans being made at the Renfrew workshops.—Messrs. Bruce Peebles and Co., at £354 and £124 respectively.
Controllers and resistances for the capstans.—The British Westinghouse Electric and Manufacturing Co., Ltd., £216.
Starters for the capstans.—Adams Manufacturing Co., £96.
Bronze worm-wheels, machine cutting of wheels and ball bearings, respectively.—Steven & Struthers, £44; Reid Gear Co., £17; and Hoffmann Manufacturing Co., Ltd., £83. On the application of Messrs. Royce, Ltd., who are making 23 electric capstans for the Trustees, it was agreed to allow them 30s. per capstan beyond the contract price, in respect of improvements desired by the mechanical engineer on the manhole covers.

The offer of Messrs. Austin & Co. has been accepted to supply an electric hoist for the Southern Police Office, at a cost of £148 10s. The following have been recommended for acceptance by the Tramways Committee.

Switchboard for depôt lighting, &c., Newlandsfield.—British Thomson-Houston Co., Ltd.
Alterations, Pollokshaws Depôt.—G. Newton & Son.
Double cotton-covered wire.—British Insulated and Helsby Cables, Ltd.

Portsmouth.—The T.C. has accepted the following tenders:—

Dick, Kerr & Co.—Armature coils.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—Mica
Estler Bros.—Cable trolley connectors.
Watlington & Co.—Car pinions and brake handle ratchets.
J. Sherwell, Ltd.—Brake shoes.
British Thomson-Houston Co., Ltd.—Lamps.

Sheffield.—The T.C. has accepted the following tenders:

British Electric Transformer Co., Ltd.—Five boosting transformers of 1,000 KW. capacity each, for a total of £2,195.
J. P. Hall & Sons, Ltd.—Boiler feed pump for the generating station (10,000 gals. per hour), £190.
Tramway Supplies, Ltd.; M. Bonser & Co.; Brecknell, Munro & Rogers, Ltd.; British Insulated & Helsby Cables, Ltd.; and W. Wood & Co.—Annual supply to the Tramways Department of overhead line material.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Tasker, Sons and Co., Ltd.; Sheffield Corporation Electric Supply Department; and T. A. Ashton, Ltd.—Electrical fittings for the Health Department.
Marsh Bros.—Maintenance of bells and telephones at hospitals for 12 months.

Southend-on-Sea.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for six single-truck tramcars, at £504 5s. each.

Spain.—MADRID.—We understand that Grice's Gas Engine Co., Ltd., Carnoustie, Dundee, have secured an order for eight gas engines and suction plants, which will develop considerably over 1,000 H.P., for a generating station for Madrid. The contract was secured against both foreign and home competition.

The Rand.—According to *African Engineering* Messrs. Babcock & Wilcox are supplying the 24 boilers required for the new Rosherville power station on the Rand. They will have a heating surface of 6,000 sq. ft. each.

West Ham.—The T.C. has extended the contract of the British Insulated and Helsby Cables, Ltd., for the supply of main cables from March 31st, for a further period of 12 months.

Wigan.—The T.C. has placed an order with Chamberlain and Hookham for 20 meters for the tramway cars.

Yarmouth.—The T.C. has accepted the following tenders for the supply of coal to the electric light works:—

W. Cory & Son, Ltd.—2,000 tons of Scotch anthracite washed nuts, at 10s. per ton, f.o.b.
Myers Rose & Co.—5,000 tons of Derbyshire fine slack coal, at 8s. per ton, f.o.b., Yarmouth.

FORTHCOMING EVENTS.

Royal Institution.—Friday, March 11th. At 9 p.m. Discourse on "Ionisation of Gases and Chemical Change," by Mr. H. B. Baker.
Saturday, March 12th. At 3 p.m. Lecture on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson. (Lecture V.)
Saturday, March 19th. At 3 p.m. Lecture on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson. (Lecture VI.)

Physical Society.—Friday, March 11th. At 8 p.m. At the Royal College of Science, South Kensington, S.W. Papers on "Coherers," by Mr. W. H. Eccles, and "Earth-Air Electric Currents," by Mr. G. C. Simpson.

Junior Institution of Engineers.—Monday, March 14th. At 7.30 p.m. At the Royal United Service Institution, Whitehall, S.W. Paper on "The Transmission of Power by Belts," by Mr. R. F. Krall.
Saturday, March 19th. At 3 p.m. Visit to the new engineering laboratory, workshops, &c., of the Finsbury Technical College.

Illuminating Engineering Society.—Tuesday, March 15th. At 8 p.m. At the Royal Society of Arts. Discussion on "The Measurement of Light and and Illumination."

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, March 15th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "A Modern Telephone Exchange," by Messrs. J. P. Garner and R. L. Bell.

Institution of Electrical Engineers (Students' Section).—Wednesday, March 16th. At 7.45 p.m. At 92, Victoria Street, S.W. Paper on "Isolated Electrical Plants," by M. R. C. Plowman.

Institution of Electrical Engineers (Yorks. Local Section).—Wednesday, March 16th. At 7.15 p.m. At the University, Sheffield. Paper on "Rating and Testing of Motors for Intermittent Working," by Dr. R. Pohl.

Institution of Electrical Engineers (London).—Thursday, March 17th. At 8 p.m. At the Institution of Civil Engineers. Adjourned discussion on Mr. Miles Walker's papers on "Short-Circuiting of Large Electric Generators and the Resulting Forces on Armature Windings," and "The Design of Turbo Field Magnets for A.C. Generators."

Northampton Institute Engineering Society.—Friday, March 18th. Paper on "Oxidation of Atmospheric Nitrogen in the Electric Arc," by Mr. S. Field. Saturday, March 9th. Visit to the National Physical Laboratory.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, March 18th. At 8 p.m. At the Glasgow Technical College. Paper on "Some Experience in Electrical Testing," by Mr. T. Buchanan.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are announced:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, March 14th.—"A" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 9.30 p.m.
Tuesday, March 15th.—"B" Company. Technical drill, 7 to 9.30 p.m.
Wednesday, March 16th.—Gymnasium, 6.30 to 9.30 p.m.
Thursday, March 17th.—"C" Company. Technical drill, 7 to 9.30 p.m.
Friday, March 18th.—"D" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 9.30 p.m.
Saturday, March 19th.—"D" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station, 3.10 p.m. Dress: Service dress with putties, greatcoat and haversack to be worn.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

NOTES.

The Elbacar Accumulator.—The secretary of the Electric Batteries and Carbons, Ltd., writes us as follows:—"With reference to the report of the Elbacar battery, which you were good enough to publish in your issue of February 25th, I am directed by my board to ask you to allow me to correct that report in two particulars. It is stated that the heavy touring car had run 1,200 miles, and that during the run the battery had been subjected 'to several capacity tests and 80 discharges at the rate of 50 amperes.' I wish to point out that the 80 discharges took place *after* the run of 1,200 miles, and, as each discharge represents a run of 50 miles, the total mileage is equivalent to a run of 5,200 miles, and, nevertheless, the plates from the same battery left with you 'appear' as you report, 'still to be in excellent condition,' therefore, the battery is certainly capable of driving the car for 5,500 miles, upon which the calculation is based, of a running cost of 0·585d. per mile.

"As regards 'the apparently low output of the battery in watt-hours per lb. of complete cell,' I beg to say that the Elbacar battery is specially designed for a quick discharge of 2½ hours, and at this rate the output in watt-hours cannot in practice exceed 7 watt-hours per lb., but, with a slow discharge of, say, 10 hours, it is possible to obtain a higher output of, say, 10 to 12 watt-hours per lb. The inventor has designedly constructed a battery with a large number of thin plates in order to obtain a largely increased active surface, and has thereby greatly surpassed in efficiency the results obtained by the two other cells to which you refer as having yielded 'still lower values in watt-hours per lb.' The results of a cell constructed for a low discharge cannot be compared with the results of a cell for quick discharge, which for practical purposes must always possess far greater economic and commercial advantages."

The P. & O. Batti-Wallahs' Society Dinner.—The annual dinner of this society was held at the Holborn Restaurant on Saturday, March 5th. As usual, during the past few years, the light-loving Batti-Wallah has been under feminine surveillance at his annual dinner. The purple past may linger lovingly in their memories, but now they are chained up to the domestic hearth on a shore job it seems necessary to keep a tight, if feminine, curb on roving instincts, and though salutary, no doubt, the chain clinks audibly. The musical programme was excellent, and the dinner good. Miss Annie Bartle, Miss May Strangeways and Mr. James Davis were deservedly appreciated, and the excellence of Mr. Alan Stainer's ventriloquial efforts was such that one was compelled to sympathise with the sorrows of lucky Jim's lay figure. What will be the Batti-Wallah of the near future? Will he be ousted from his job by the march of feminine progress? Can he continue to find happy hours on the sunlit deck when he should be commutating down below? We sound this note of warning simply because the best speech of the evening was that of a lady, Mrs. Waterhouse. Would the P. & O. ships be better lighted under feminine control?

Hackney Electric Rifle Club.—Mr. E. Matthews, hon. secretary of this club, of which the borough electrical engineer, Mr. L. L. Robinson, is the president, writes to inform us that the club has been formed in connection with the employés engaged at the Metropolitan Borough of Hackney Electricity Works; a 25-yard range is being built on land adjoining the works, and will be ready for practice soon after Easter. The secretary will be very pleased to hear from any other rifle clubs in connection with the electricity works within the Metropolitan area, with a view to arranging post or shoulder-to-shoulder matches. If there should be a sufficient number of such clubs, it is possible that a very interesting competition on the league principle might be formed. With regard to the range and butts, provided the necessary space is available, the actual cost is not great, as the scrap heap will furnish most of the material required, and the upkeep is practically nil, whilst the necessary labour can be obtained from the members

after working hours. Mr. Mathews, who may be addressed at the Electricity Works, Millfields Road, Clapton, will be very pleased to give any information as to the method adopted at Hackney, and hopes this announcement will be the means of the formation of similar clubs. As a matter of fact, there is already in existence a National League of Local Government Officers' Rifle Clubs, and our readers are aware that at Brighton and one or two other towns there are rifle clubs attached to the electricity works. The Electrical Review cordially supports the movement, having a rifle club of its own, numbering some 25 members.

Parliamentary.—London County Council Tramways and Improvements Bill.—On Tuesday, the Select Committee on Standing Orders, Mr. J. E. Ellis presiding, had the Bill promoted by the London County Council before it. The measure had been sent up by the Examiners, who had found the Bill not complying with Standing Orders. The Committee, after deliberating in private, allowed the Bill to proceed, subject to the parts relating to the construction or reconstruction of tramways in the following areas being struck out, viz.:—Kensington, Hammersmith, Paddington, Hampstead, St. Marylebone, Islington, Lambeth, Willesden and Camberwell.

Institution and Lecture Notes.—Royal Institution.—The following are among the lecture arrangements at the Royal Institution after Easter:—Dr. W. Rosenhain, two lectures on "The Constitution and Internal Structure of Alloys"; Prof. J. A. Fleming, two lectures on "Electric Heating and Pyrometry" (The Tyndall Lectures).

At Whitehaven, last week, it was decided to form a Cumberland branch of the Institution of Mining Electrical Engineers, with Mr. T. P. Martin, of Workington, as president.

Junior Institution of Engineers.—A combined meeting of this Institution and of the Architectural Association Debating Society recently took place for the consideration of the subject of "Town Planning."

Engineering Standards Committee.—With the view of assisting the Committee to meet the heavy expenses incurred in the preparation of its reports, it has been decided to make certain alterations in the Committee's Price List after March 31st next. The prices of 21 of the Reports will be raised, the prices of 28 will remain unaltered and the price of one Report, namely, that dealing with the Properties of British Standard Sections (Report No. 6) has been reduced with a view to its more readily finding its way into the hands of draughtsmen and others engaged in constructional work. Copies of the revised Price List can be obtained upon application to the Secretary of the Engineering Standards Committee, 28, Victoria Street, Westminster, S.W., or to Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., the official publishers to the Committee.

Russian Exhibition Abandoned.—It is reported that the project for a Russian Exhibition in London next year has been abandoned.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials. — A correspondent at Leicester informs us that Mr. A. Colson, engineer of the Leicester Corporation Gas and Electric Lighting Department, is lying seriously ill in a nursing home in London. On Monday Mr. Colson underwent an operation for an internal disorder, and though this was quite successful, the patient is in a weak, and even critical, condition. His many friends will wish him a speedy and permanent recovery.

Mr. R. W. Grubb, of Swindon, has been appointed chief assistant electrical engineer at the Dewsbury Corporation Electricity works.

The Dartford U.D.C. has increased the salary of the electrical engineer, Mr. J. D. Pember, from £250 to £275 per annum.

The Croydon T.C. has decided to increase the salary of Mr. Daniel Cowan, mechanical superintendent at the electricity works, from £200 per annum, by £10 a year, to a maximum of £250.

Tramway Officials.—The Halifax T.C. has granted an honorarium of £150 to Mr. Rogerson, general manager of the tramways, in recognition of special services rendered to the undertaking during the past two years. Mr. Caird, tramway traffic superintendent, has been appointed traffic manager at a salary of £250 per annum, rising to £275, and Mr. Galloway, rolling stock superintendent, has been appointed tramways engineer at a salary of £250, an increase from £160.

Mr. Harold Hett, assistant tramway engineer at Torquay, who, as already mentioned, is leaving for Canada, has been presented by the staff with a sporting rifle.

The Keighley T.C. Tramways Committee has appointed Mr. Eli Murgatroyd as tramway manager, at a salary of £110 per annum.

Mr. C. W. Mallins, general manager of the Liverpool Corporation tramways, who has completed 36 years' service in connection with the tramways, has been presented with an illuminated address, and valuable breast pin, as testimony to the high esteem in which he is held by the 1,800 employés of that department, and their appreciation of his talent and business capacity, inventive genius and resource, combined with kindness and consideration to all. Sir Chas. Petrie (chairman of the Tramways Committee), handed the gifts to Mr. Mallins, on behalf of the donors, the Tramways Employés' Social and Thrift Society.

The West Ham Tramways Committee has endorsed the recommendation of the tramways manager that the salary of Mr. F. Eggington, principal assistant, be increased from £225 to £240, with a further increase of £10 in 12 months.

General.—The Blackburn Chamber of Commerce on March 3rd appointed Mr. S. J. A. Mills consulting engineer on the Board of Arbitration for the ensuing year, along with Mr. C. T. Briscoe, electrician.

Mr. A. W. Empson has recently resigned his position with the Charing Cross, West End and City Electricity Supply Co., Ltd., in order to take over the management of the Cast-Iron Brazing Co., in India. Mr. Empson is at present in Calcutta, where workshops are already running, and he will shortly open branches in various parts of India.

Mr. C. W. Humphreys, of Cardiff, has been appointed secretary of the newly-formed branch of the South Wales Institute of Mining Electrical Engineers.

The engineering staff connected with the Post Office Telegraphs in the Midland district last week entertained at a complimentary banquet Mr. G. W. Hook, superintending electrician, and Mr. R. Johnson, assistant superintendent engineer, both of whom are about to retire after 41 and 46 years' service respectively. The retiring officials are being succeeded by Mr. E. J. Eldridge and Mr. J. W. Sullivan, both of London.

Mr. Nathan Gunz, manufacturer's agent, of 46, Queen Victoria Street, E.C., has changed his name, which in future will be Nathan Gunn. He has severed his connection with the General Metal Engraving Co., of which he acted as manager until recently, and is now carrying on that name-plate business on his own account as the "Gunn" Metal Engraving Co.

Mr. W. E. Chappell has vacated his position as district engineer in the Birmingham area to the British Westinghouse Electrical and Manufacturing Co., Ltd., to take up (as from March 1st) the position of chief electrical engineer to the Staveley Coal and Iron Co., Ltd., Chesterfield.

Mr E. Greenhalgh, at present a London district traveller with the Hart Accumulator Co., Ltd., has been appointed works manager with Messrs. W. O. Rooper & Co., of Stafford. The Hart Co. ask us to state that he is not representing them after to-morrow, the 12th inst.

Mr. C. C. Silvers, one of the assistants in the Wolverhampton Corporation Tramways Engineering Department, is leaving to take up an appointment as assistant engineer with the Tudor Engineering Co, London. On Friday last week his colleagues presented him with a travelling bag and case of brushes. The presentation was made by Mr Luntley, the general manager of the department.

Mr. R. Turnbull Mawdesley, who has lately been in charge of the electrical department at Messrs. Blériot, Ltd., has been appointed chief electrical and mechanical engineer to the Santa Isabel United Gold Mines, Ltd., and will shortly take up his duties. He sails from Liverpool on the 12th inst. on the *Mauretania* to New York.

Mr. James Swinburne has retired from the firm of Swinburne, O'Gorman & Baillie. He, and the firm, continue their respective practices at 82, Victoria Street, Westminster.

Prof. Payne recently left Cape Town for Australia to take up his new appointment at the Melbourne University. His successor in the Engineering Chair of the South African College will be Mr. A. E. Snape, who is M.Sc. of the Victoria University, of Manchester, and an Associate Member of the Institution of Civil Engineers. Mr. Snape is at present borough sewerage engineer of Norwich. He was selected for his new appointment by a very strong and representative committee in London. Prof. Payne was entertained at a banquet at the Royal Hotel, Cape Town, prior to his departure.

Obituary.—Mr. H. Pinnell.—The death occurred on February 23rd of Mr. Henry Pinnell, J.P., of the firm of W. Whitehouse & Co., Ltd., manufacturers of electric light fittings, of the Empire Works, Birmingham. The deceased gentleman was 52 years of age, a magistrate for Warwickshire, and a prominent Liberal and Freemason.

Mr. R. Butterworth.—The death is announced, at the age of 51 years, of Mr. Robert Butterworth, of Higher Crumpsall, Manchester, who had for 22 years been connected with the General Electric Co, Ltd.

Mr. James Hornsby.—The death occurred on March 6th of Mr. James Hornsby, head of the well-known engineering firm of R. Hornsby & Sons, Grantham, at the age of 75 years.

NEW COMPANIES REGISTERED.

Holsworthy Gas and Electric Supply Co., Ltd. (107,456).—This company was registered on February 11th, with a capital of £ 0,000 in £1 shares, to take over (1) the assets and liabilities of the Holsworthy Gas Co., and (2) the business and undertaking of electric lighting and supply of electric light and power carried on by W. H. Barkell, of Holsworthy. The subscribers (with one share each) are:—S. Parson, Bodmin Street, Holsworthy, builder and contractor; W. Daniel, Lower Square, Holsworthy, provision dealer; W. S. Bray, Chesty Eley, Holsworthy, bank manager; A. K. Peter, Bodmeyrie, Holsworthy, solicitor; E. H. Rudland, Chasty, Holsworthy, merchant; C. Webb, White Hart Hotel, Holsworthy, hotel proprietor; R. Penwarden, jun., Bodmin Street, Holsworthy, insurance agent. Minimum cash subscription 1,000 shares. The number of directors is not to be less than five or more than seven; the first are W. T. Kivell, W. H. Barkell, W. Harris, S. Parsons, W. Daniel, W. S. Bray and A. K. Peter; qualification, £200; remuneration as fixed by the company. Registered office, 8, Fore Street, Holsworthy, Devon.

West Naples Tramways and Valfortore Railway Co., Ltd. (107,486).—This company was registered on February 10th, with a capital of £50,000 in £1 shares, to acquire a concession granted to A. Capuano for the construction and maintenance of a light railway or tramway, with electric traction, between Naples, Soccavo, Pianura and certain other places, with a deviation to Camadoli, together with the benefit of certain resolutions passed and grants made in favour of a further concession applied for by the said A. Capuano for the construction and maintenance of railway between Benevento, San Bartolomeo, in Galdo, and San Severo, Lucerna, and extensions to other places. The subscribers (with one share each) are:—Lord Templemore, 4, Portman Square, W.; A. Capuano, 35, Strada Santa Lucia, Napoli, engineer; De Vere Beauclerk, 40, Princes Square, W., gentleman; H. W. Preston, 40, Old Broad Street, E.C., solicitor; L. M. Messiner, Eastcheap Buildings, E.C., merchant; J. M. Joanides, 46, Lady Margaret Road, Tufnell Park, gentleman; A. S. Jackson, Bush Lane House, Cannon Street, E.C., solicitor. Minimum cash subscription, 25 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than seven; the first are the Right Hon. Lord Templemore and A. Capuano; qualification, £250; remuneration (except managing directors), £100 each per annum (chairman, £150); purchase consideration, £10,000 (£3,000 in cash and £7,000 in shares). Registered office, 57, Gracechurch Street, E.C.

British Electro-Metallurgical Products Co., Ltd. (107,439).—This company was registered on February 11th, with a capital of £100,000 in £1 shares (60,000 7 per cent. non-cumulative preferred ordinary), to carry on the business of manufacturers of and dealers in chemicals and by-products, metallurgists, generators, distributors and suppliers of electrical energy, &c., and to adopt an agreement with Electro-Metallurgical Syndicate, Ltd. The subscribers (with one share each) are:—W. L. Madgen, Falcon Works, Loughborough, electrical engineer; J. J. Steinitz, Falcon Works, Loughborough, electrical engineer; C. J. Head, F.I.C., 25, Victoria Street, Westminster; W. D. Rock, 62, Leadenhall Street, E.C., engineer; J. R. Easton, C.E., 25, Victoria Street, S.W.; R. O. Ahliss, A.M.I.C.E., A.M.I.M.M., Holly Bank, Godalming; W. G. Jarrett, Holmleigh, Holden Road, Woodside Park, N., retired bank accountant. Minimum cash subscription, £1,000. The directors are to number not less than three or more than seven: C. J. Head is one of the first; qualification, £250; remuneration, £300 each per annum (chairman £400) and 2½ per cent. of the surplus profits available for dividend after 7 per cent. has been paid on the ordinary shares. Registered office, 25, Victoria Street, Westminster.

CITY NOTES.

South London Electric Supply Corporation, Ltd.

The directors' report for the year ended December 31st, 1909, states that the gross receipts have been £39,076, while expenditure has been £18,246, leaving a profit balance of £20,830, plus £1,770, brought forward. There is a total amount available of £22,600. After providing for depreciation on plant and machinery, &c., debenture and other interest accrued, £8,475, there remains to be carried to the general balance-sheet £14,125. Out of this the board recommend the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, amounting to £13,000, carrying forward a balance of £1,125. At the end of 1909 there were connected to the company's mains the equivalent of 210,395 8-c.p. (or 35-watt) lamps, showing a net increase for the year of 22,468 upon last year's figures. Applications were also in hand for a further 5,000 lamps not then connected to the circuit. During the year under review the plant, machinery and mains have been maintained out of revenue in a high state of efficiency. Notwithstanding the extended use of the new metallic-filament lamps which consume considerably less current than the old carbon lamps, the gross revenue for the year is in excess of that of the previous year by £2,061. The units sold, which amount to 3,705,208, show an increase of 522,388, or 16·5 per cent. in excess of the previous year, the total cost per unit sold being 1·18d., as against 1·34d. in 1908, a reduction of nearly 12 per cent. The ratio of total costs to revenue is 46·7 per cent.

The meeting is called for March 15th.

Units generated	4,727,860
Sold to consumers and used by public arc lamps ..	3,705,208
Used on works	296,410
Total	4,001,618
Expended in distribution	726,342
Total connections in kw., December 31st, 1909 ..	7,364

Hastings and District Tramways Co., Ltd.—The report states that the revenue account for the year ended December 31st shows that there has been a decrease in the gross receipts of £1,493, due to a continuance of the general depression. There have, however, been savings in expenses under all heads amounting to £2,486, the result of the account being a credit balance of £20,749, which has been handed over by the statutory company as dividend upon its shares, which are all owned by this company. The revenue account of this company shows receipts aggregating £20,760, against £19,767, and expenses of administration £1,405, as against £2,100, or a saving of £695, mainly due to the directors having taken only half fees for the year. The balance is £19,354, which, after adding the amount brought forward, £417, against £1,767 last year, and deducting £11,129 for debenture and bank interest, &c., leaves available the sum of £8,642. The directors consider that in previous years an insufficient sum has been set aside for depreciation. They therefore propose on this occasion to transfer £8,000 to depreciation account, and to carry forward £642.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Desrumaux's Automatic Water Softener and Purifier, Ltd.
Electric Royalties Syndicate, Ltd.
Hampstead Electric Supply Co., Ltd.
Harry South & Co., Ltd.
Helicoid Locknut Patents (Parent) Co., Ltd.
Hydro-Kinetic Engineering Syndicate, Ltd.
Medical Battery Co., Ltd. (Registered September 27th, 1898).
Midland Electrical and General Engineering Co., Ltd.
Motor Traction Co., Ltd.
Pioneer Electric Light and Power Co., of China, Ltd.
S.M. Van Hinden's Electrical Co., Ltd.
Willoughby Destructor Syndicate, Ltd.

Vickers, Sons and Maxim, Ltd.—The directors recommend a final dividend of 1s. per share on the ordinary shares, making 2s. per share, or 10 per cent. for the year, carrying forward £33,927.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

British Columbia Electric Railway Co.—Further issue of £200,000 5 per cent. cumulative perpetual preference stock, £200,000 preferred ordinary stock, and £100,000 deferred ordinary stock.
Metropolitan Electric Supply Co.—Further issue of £15,000 4½ per cent. first mortgage debenture stock.

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

County of London Electric Supply Co.—Further issue of £50,000 4½ per cent. second debenture stock.

France.—La Société Versaillaise de Tramways Electriques et de Distribution d'Energie, of Versailles, is declaring dividends of 32½ fr. on the preference shares, and 27½ fr. on the ordinary shares, for the last financial year.

Prospectuses.—*Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.*—This company is offering until to-day, Friday, 94,993 shares of £1 each and £80,000 6 per cent. first mortgage convertible debenture stock, both at par. Sir Douglas Fox and Partners are consulting engineers to the company, which has been formed for the purpose of acquiring certain concessions granted by the Municipalities of Benguella and Catumbella for the supply of electricity for illumination and power to these towns, including the port of Lobito, Portuguese South-West Africa. The company will have a 99-years' monopoly under the Portuguese Government, and it will make use of the waterfall of the Catumbella River. According to the prospectus: "The river passes through the town of Catumbella, and the quantity of water at the fall is sufficient, even in dry seasons, to develop 4,000 H.P., which can be increased by raising the height of the dam. The present requirements of this company will, it is estimated, be about 800 H.P. The towns of Benguella, Catumbella and the port of Lobito are the chief towns in the Province of Benguella, Colony of Angola, Portuguese South-West Africa, which has a population of about 4 millions. The two former towns have been in existence for the past 300 years and carry on a large trade with the hinterland. They also carry on a large import and export trade with Europe. Benguella is the seat of the Government, and is situated 14 miles from Catumbella, and contains many large Portuguese, Belgian and Italian business houses and several hotels. Catumbella is situate 8 miles from the port of Lobito, and there are many important business houses, sugar plantations and distilleries there. Lobito Bay, which is 1½ miles in breadth and 3½ miles in length, is considered the finest natural harbour on the West Coast. There is a pier wharf of over 1,000 ft. in length, which enables the steamers of the Union Castle, Elder Dempster, Empreza Nationale and Woermann Lines, and other boats which call there, to load and unload at all times. Owing to this port being the Atlantic terminus of the Benguella Railway, the port of Lobito is rapidly developing, and numerous large buildings are now being erected, including hotels, Custom House buildings, and warehouses." The prospectus contains estimates as to revenue, &c. The Peninsular Development Syndicate, Ltd., are under contract to construct, erect and equip the plant to the consulting engineers' specification, and to hand over the same as a going concern to the company by March 31st, 1911.

Buenos Ayres Lacroze Tramways Co.—The list closed yesterday in an issue of £350,000 5 per cent. extension mortgage debentures, offered at 90 per cent.

Hadfield's Steel Foundry Co., Ltd.—The directors in their report showing the position of the company at December 31st, 1909, recommend that in addition to the interim dividend of 1s. per share paid in August last on the ordinary shares, a further dividend be paid on the ordinary shares of 2s. per share, together with a bonus of 6d. per share (all free of income-tax), carrying forward the balance of £29,324. Sir Robert Hadfield, the chairman of the company, has, in accordance with his doctor's advice, gone abroad for a few months, and he is now completely restored to health. He is at present in Ceylon, and much regrets that for the first time since the company's formation he will be absent from the annual meeting on March 17th.

Stewarts & Lloyds, Ltd.—The directors have decided, after setting aside £70,000 for depreciation, to recommend for the half-year to December 31st last, dividends at the rate of 5 per cent. per annum on the preference shares, 10 per cent. per annum on the preferred ordinary shares, and a dividend of 1s. per share on the shares, placing £30,000 to reserve fund and carrying forward deferred £81,000.

Scarborough Electric Supply Co., Ltd.—The directors recommend a dividend of 3 per cent. for the year, carrying forward £851.

Sao Paulo Tram, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. is announced.

Gateshead and District Tramways Co.—The directors have declared a dividend of 6 per cent. on the ordinary shares for the past year.

Winnipeg Electric Railway Co.—A dividend of 2½ per cent. for the quarter to March 31st has been declared.

City of London Electric Lighting Co., Ltd.

The directors report that the capital expenditure during the year 1909 has been:—New buildings, plant, mains, &c.: Additions and extensions, £49,903; to replace works dismantled, £9,037 = £58,940, making £2,371,757, less amount written off prior to December 31st, 1908, £208,897; and further amount written off in respect of buildings, plant and other works dismantled during 1909, £21,503, leaving net expenditure, December, 1909, £2,141,357, which represents a net addition to capital account during 1909 of £37,437.

The first debenture stock premium redemption account has been credited with £1,373 from revenue for interest, raising the amount at the credit of the redemption account at December, 1909, to £58,637. There has also been transferred from net revenue account (No. V) to reserve account (No. VI), £45,000. The balance at credit of reserve account (No. VI) as at December, 1909, stood at £259,217; in addition to which there were:—First debenture stock premium redemption account, £58,637; leasehold redemption account, £3,742; standing reserve for doubtful debts, &c., £3,000; dividend equalisation fund, £10,000; amount proposed to be carried forward to 1910, £25,668, making the total reserves, £360,265. Revenue: The total revenue for the year was £286,302 plus interest on investments and discounts £1,859 = £288,161, from which must be deducted the following items:—Expenses of generation and distribution, £67,850; repairs and maintenance of buildings, machinery, plant, mains and other works, £11,382; rent, rates, taxes, management expenses and special charges, £48,272, leaving £160,656, plus £27,404 brought forward, making a total available revenue of £188,060. Of this sum the following amounts have been distributed or provided for:—Interest on loan from bankers, consumers' deposits, &c., £3,665, interest on first and second debenture stock for year 1909, £31,616, interest transferred to debenture stock premium redemption account, £1,373; leasehold redemption account, interest and appropriation, £242; staff superannuation fund, £366; stores written down, £585; experimental street lighting, £287; transfer to reserve account, £45,000, leaving available for dividends on preference and ordinary shares and for "carry forward" to 1910, £104,926. The directors now recommend dividends for the year, subject to the deduction of income-tax, of 12s. per share (6 per cent. per annum) on the preference, and 14s. per share (7 per cent. per annum) on the ordinary shares, requiring £69,257. A dividend equalisation fund is to be formed by transferring thereto £10,000, and there is to be carried forward to 1910, £25,668. Warrants for the balance dividends will be posted on March 16th. The following tables show the position of the company as it was at the end of 1909 and at previous periods:—

Revenue.	Dec., 1907.	Dec., 1908.	Dec., 1909.	Increase over 1908.
Gross revenue from all sources ..	£280,860	£283,239	£288,161	£4,922
Net revenue available for reserve, interest on debenture stock, &c., dividends and special charges ..	158,749	153,387	160,656	7,269

Private Supply for all Purposes: Average Prices per Unit Obtained.

1907.	1908.	1909.
2·63d.	2·55d.	2·49d.

The following is the total number of customers and connections, after allowing for disconnections on account of removals, substitutions of metallic-filament lamps, &c. (Private supply):—

	Dec., 1907.	Dec., 1908.	Dec., 1909.	Increase over 1908.
No. of customers supplied ..	12,521	12,882	13,338	456
No. of kw. connected (including power and heating) ..	33,681	35,468	35,915	447

On February 16th, 1910, there were 37,353 kw. applied for, out of which 36,065 were connected, and the customers numbered 13,389.

Total Units Generated (Including Public Street Lighting).

	1908.	1909.
Generated	27,315,608	29,146,295
Sold	24,560,406	25,454,485
Metered and used by the company ..	739,035	864,403
Expended in distribution, &c. ..	2,016,167	2,827,407
Maximum supply demanded, kw. ..	19,163	19,288

The total units sold during 1909 show an increase of 894,079 over the quantity sold during 1908.

The power and heating supplies continue to show a steady increase, the total sold for these purposes in 1909 being, power, 6,755,177 units; heating, 1,307,778 = 8,062,955 units, together being equal to 33·3 per cent. of the total units sold for private supply. The company, at the request of the Corporation of London, has submitted a scheme for carrying out a further demonstration of more modern lighting in certain thoroughfares, which is under consideration by the Corporation. Otherwise the matter remains in the same position as hitherto.

The Electric Lighting Act (1909) promoted by the Board of Trade has, after much delay, been passed. Many of its provisions had already been secured by the passage of the London Electric Supply Act (1908), but it contains certain clauses which will be of value to electric supply undertakings.

British Insulated and Helsby Cables, Ltd.—A final dividend of 6s. per share, making 10s. per share for the past year, is announced. It is proposed to place £33,500 to reserve and depreciation, and to carry forward £42,000.

Gateshead and District Tramways Co., Ltd.—A dividend of 6 per cent. on the ordinary shares for the year 1909 is announced.

W. T. Glover & Co., Ltd.

The directors' report for the year ending December 31st, 1909, shows that the result of the trading is a credit balance of £26,231, plus £11,063 balance brought forward = £37,294. Deduct—directors' remuneration, voted March, 1909, £1,000, directors' expenses during 1909, £52, interest (at 4½ per cent.) on first mortgage debenture stock £4,250, interest (at 5 per cent.) on second mortgage debenture stock £3,800, also deduct appropriation for payment to trustees of second mortgage debenture stock £4,000, leaving a balance of £24,192. It is proposed to pay a dividend on 5 per cent. cumulative preference shares (£100,000) to December 31st, 1909, less income-tax, £4,719, transfer to first mortgage debenture redemption fund £2,500, payment of dividend on ordinary shares (£114,850) at the rate of 5 per cent., less income-tax, £5,419, leaving to be carried forward £11,554. The directors have pleasure in recommending the payment of the dividend on the 5 per cent. cumulate preference shares for the year ending December 31st, 1909, and also the payment of a dividend on the ordinary shares at the rate of 5 per cent. for the same period. The depression of trade mentioned in the last report has continued in the cable industry throughout the past year. The revision of the articles of association of the company has been completed, and they will be submitted for adoption to an extraordinary general meeting at the close of the annual meeting on Monday next.

Direct Spanish Telegraph Co., Ltd.

The directors' report for the year ended December 31st, 1909, states that after providing for interest on, and redemption of, debentures, and for the dividend of 10 per cent. on the preference shares, a balance of £7,644. Out of this amount the sum of £5,000 has been transferred to the reserve fund, and the directors recommend the payment of a final dividend for the half-year ended December 31st, 1909, at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, amounting to £1,293. This, with the interim dividend paid on October 1st, 1909, makes a total distribution of 4 per cent. for the year. The remaining balance of £58 has been transferred to the contingencies account. The traffic receipts show an increase of £1,087, and the working expenses an increase of £402 as compared with 1908. As referred to in the last report, the Bilbao cable became interrupted on January 19th, 1909, close to the landing place in Spain. Its repair was successfully carried out locally, communication being restored on February 3rd. On November 1st, 1909, the Bilbao cable was again interrupted at about 181 knots from Falmouth, the repairs being carried out by the Eastern Telegraph Co.'s cable steamer *Duplex*. Communication was restored on November 6th. The cost of these two repairs, viz., £3,215, has been charged to revenue.

The meeting is to be held on Wednesday, March 16th.

Harrow Electric Light and Power Co., Ltd.

The directors report that during 1909, 101 new consumers representing 1,772 additional lamps have been connected to the mains, bringing up the total consumers to 1,223, their representing the equivalent of 36,376 lamps. The output of electrical energy, notwithstanding the influence of the new metal-filament lamps, shows a favourable increase, 410,276 units having been sold to the consumers as against the 400,402 units sold in the previous year. The extension of the generating works has been completed and the new plant has proved to be highly efficient and economical. Various small extensions of the distributing mains have been carried out during the year to meet the demands of new consumers. The re-arrangements of the debenture capital have been carried out in accordance with the terms reported at the last meeting. There is a balance of £5,950 of the new 4½ per cent. debentures still available for issue, which the directors are prepared to reserve for a reasonable period for the shareholders and existing debenture-holders. A part of this balance has already been applied for, and further applications will be dealt with as they are submitted. These should state the amount of the debentures required and the date (which should not be earlier than June 1st, 1910) upon which it is desired to take them up. The balance to the credit of the net revenue account, after deducting debenture interest and the interim dividend on the preference shares, is £2,491, out of which the directors recommend the payment of the final dividend on the preference shares, £375; a dividend on the ordinary shares at the rate of 5 per cent. per annum, £1,667; leaving to be carried forward £449. The directors have deemed it prudent to set aside out of the year's profits £2,400 for depreciation purposes.

The annual meeting was held on February 24th at Harrow, Mr. J. N. Stuart presiding.

The Chairman said that the report showed a record of fair progress, nothing out of the way, but steady. The increase in the number of consumers was larger than that of any of the three previous years, but the increase in the number of lamp connections was not so great as in 1906 or 1907; this was due to the fact that the larger houses in the district were nearly all installed with electric light, and they had now to go to the smaller houses for an increase in their consumers. The increase in units sold was only 2½ per cent.; that it was not more was due to the increased use of metal-filament

lamps, which, while appearing to be against the interests of the company, were really indirectly in its favour, for as people realised that consumers were getting their light cheaper new customers would come in. As as proof of the progress made by metal-filament lamps, 72 per cent. of the lamps sold by their wiring department were of that type. A notable feature of their records was that the consumption by slot meters was nearly 50 per cent. above that of 1908, and more than double the consumption of two years ago, showing that small houses were finding this method of lighting satisfactory and economical. The revenue showed an increase of nearly £500, and the working expenses a reduction of £23. The coal bill was less by about £150, but in rates and taxes, establishment charges, and upkeep of mains, there was a slight increase. The serious item in the cost sheet was the steadily increasing expenditure under the head of "Distribution." On this head he could not hold out immediate hopes of reduction, as they were of opinion that the mains must be put into thoroughly sound condition, and all weak places gradually rectified. During the current year the result of the new plant would show more clearly in the accounts, as, of course, the new plant was not working during the whole of the past year.

Mr. G. Townsend Warner seconded, and the resolution was carried unanimously.

Mr. G. W. Spencer Hawes, in acknowledging his re-election as a director, said he would like to emphasise the fact that their working cost per unit of output, which was a very important factor, had been very materially improved, that being largely due to the economies effected in coal consumption, and the lower they could bring down their coal cost, the better would be the financial position of the company.

Thanks given to the manager, staff and directors, were acknowledged by the Chairman and by Mr. J. A. Bernard Horsley, the engineer and manager of the company.

A demonstration of electric ironing was giving prior to the meeting.

Mersey Railway Co.

The half-yearly general meeting of the above company was held at Worcester House, Walbrook, on Tuesday, under the chairmanship of Mr. James Falconer, M.P.

In moving the adoption of the report (see Electrical Review, page 355), the Chairman said it was a pleasure to the board to be able to report that during the half-year under consideration the satisfactory progress of the undertaking had been more than maintained. Dealing with the half-year ending December 31st last, and comparing the figures with the corresponding of 1908, they would find the receipts for the last half-year were £54,363, as against £52,193 in the half of 1908, or an increase of £2,170, and this was notwithstanding the fact that they had been still experiencing the effects of the continued depression in trade. The expenditure was £33,791, against £37,699, or a decrease of £3,908. Consequently there was an improvement of £6,078 in the net revenue of the company for the half-year, which was a record in their experience and spoke well not only for the prosperity of the undertaking, but also for the efficiency with which its affairs had been conducted. Taking the figures for the whole year and comparing them with those of 1908, for the whole year of 1908, the receipts amounted to £103,977, and for 1909 they amounted to £107,591, an increase of £3,614. The expenditure in 1908 was £74,844, and in 1909 it was £68,361, a reduction of £6,583, so that the improvement in the net revenue was £10,197. It was right that he should explain that this improvement was due to circumstances which, to a certain extent, were exceptional and could not be expected to recur every year. For one thing, they had changed their headquarters from London to Birkenhead, and concentrated the whole of their management in the centre of their undertaking, and had put Mr. Shaw, the general manager, on the spot, with full power to deal with all the departments of the undertaking. The result had been that, without any violent changes, the organisation had been better, and it had been possible to adapt the services they were giving more closely to the needs of the passengers at different hours of the day in which they travelled. The result undoubtedly had been a very substantial economy without in any way impairing the service given to the public. But the great outstanding feature which had been brought home to the board year after year was that the railway was serving the great purpose for which it was constructed, viz, the transfer of passengers between Liverpool and the Cheshire side of the Mersey, and it was most satisfactory to know that their traffic was not derived by taking away traffic from any existing route, but was really received from the people of the districts they served. He did not profess to give any forecast as to the future, but it must be obvious to everyone that whilst they had Liverpool with three-quarters of a million of people on one side of the river, and that on the other side there was perhaps the finest residential district which was to be found near any large town in the kingdom, traffic was capable of very great, and he had almost said, unlimited expansion. That was the principle they had proceeded on ever since the electric working had been commenced, and they intended to continue to give the best services they could to those they served. He knew that the shareholders always seemed to be interested in hearing of the progress made since the electrification of the line. In the half-year ending December 31st, 1902, which was the last half-year of their steam working, they carried 2,800,000 passengers, exclusive of season ticket-holders, whilst last half-year they carried 5,900,000 passengers, or an increase of over 3,000,000, or 108 per cent. In the last half-year of steam working they estimated the journeys of season ticket-holders to be 512,980, and last half-year they were 1,291,190, or an increase of 152 per cent. Their receipts for the last half-year of 1902 were £29,470, whilst in the last half of 1909 they were £54,363, or an increase of 84 per cent. Everyone would realise that they a long road to go before anything like an adequate return could be earned by the company upon the large share capital necessary for its construction, but at the same time it was their business to make the greatest progress they could towards that goal, and to deal with the situation as effectively as they could, and he thought that the extent they had gone forward in the last year would commend itself to the shareholders. They were bringing in a Bill this session for extending for a period of five years, the time during which the interest upon certain of the debenture stocks was dependent upon the profits of the company available for each year, and also the period during which the representatives of the debenture-holders should sit on the board. The scheme was inaugurated in 1900, and had worked admirably, and there was every prospect of the Bill going through.

The Hon. C. Clare Parsons seconded the motion.

Answering a question by Mr. J. Skerrett, the Chairman said the reduction in the expenditure for pumping was due to the fact that the engineer had, after making experiments, done the pumping from the Birkenhead side of the tunnel where their generating station was. They had pumps on either side of the river, but were now only keeping the Liverpool pumps as a standby. The water came partly from the river and partly from the strata.

Mr. Skerrett said it looked then, as if like the poor, they would have it always with them.

Mr. G. Waddell said the amount of water now dealt with was about a third less than it used to be.

Mr. J. Skerrett said the stock of all kinds now was about £3,600,000, and he took it if the railway was to be constructed it would cost much less to build. To pay a dividend of 5 per cent. on the stock would mean earning £180,000 a year, plus the cost of maintenance. He asked whether it would not be possible to arrange for a reduction in the capital of all kinds. If it could be written down to something like £1,500,000 then they might pay a dividend. He moved: "That having considered the balance-sheet of the Mersey Railway Co. for the half-year ending December 31st, 1909, resolved that the directors be asked to consider the question of decreasing the share capital of the said railway with a view to the payment of dividends."

Mr. Elliott seconded the amendment.

The Chairman said that this question was considered in 1900, when they had to face the position of raising money to electrify the railway. As the result of negotiations they induced the debenture-holders to allow over £700,000 of debentures to be placed before them, to write down the interest on their stock and to accept ordinary stock in payment of the £500,000 of interest due to them. The debenture-holders generously agreed, and he thought they were reaching the time when the debenture-holders would reap the reward of their generosity in the past. He could not ask the debenture-holders to make any further sacrifice, because there was no ground for asking them, and, in fact, they had agreed to extend for another five years the period when the payment of their interest was dependent on the earnings in each year. Then with regard to the holders of preference stock, they accepted 3 per cent. instead of 5 per cent., which meant a writing down of value of 40 per cent., and again he did not think they could ask for more. Of course, so far as the ordinary shares were concerned, it was open to the holders to make them of any denomination, but he saw no object to be served in doing this, because, after all, the value of the stock was the value on the market. He would point out further that they did not pay 5 per cent. on their stocks, and, therefore, Mr. Skerrett's figure of £180,000 could be very materially reduced.

The amendment was withdrawn, and the resolution for the adoption of the report was agreed to.

Mr. Waddell was reappointed a director, and, in thanking the shareholders, said that if they were commencing to build the tunnel that day it would cost them far more than it actually did cost them. He hoped to live to see the ordinary shareholders get a return on their capital, for they had a splendid property in the tunnel.

W. T. Henley's Telegraph Works Co., Ltd.

Mr. Sydney Gedge (chairman) presided last Friday, at the Great Eastern Hotel, E.C., over the thirty-first ordinary general meeting of the above company.

In moving the adoption of the report (Electrical Review, page 312), the Chairman said that was the twenty-fifth meeting over which he had presided as chairman, and he could truly say that on no previous occasion had he so much pleasure in undertaking the duty. The company had kept on the noiseless tenure of its way, uninterrupted by strikes and disputes with workmen, and uninterrupted by accidents or any serious circumstances. As usual, there was every good feeling between the managers and the board on one hand and the workmen on the other. Things had gone on smoothly, and business had been excellent. The items in the accounts were similar to last year, only more in favour of the company, and the general result was that in a year which had not been particularly good for trade generally they had made more profit than they had ever before made; had declared the same dividend of 15 per cent.; had carried forward a larger balance; and, after making liberal deductions for dilapidations, reserves and so forth, they had a balance of £200,000 in hand over all their liabilities. In other words, the whole of their ordinary capital might be returned to the shareholders if it were not that they could do much better for them by employing it in the business. The reserve under the cable

repairing contract with the Bahamas Government now exceeded £8,000. At the end of two years their liability would be at an end, and he had reasonable hopes that at that time they would have nearly the whole of that £8,000 to divide between the company and the Government.

Mr. George Sutton (managing director), in seconding, said that the year under review had had its anxieties which had been experienced by all businesses, but it had had its gratifications also, which was shown by the profit and loss account. Perhaps the best feature of last year was the development and extension of the foreign and colonial trade of the company. Henley's goods had found their way, and were finding their way, into all parts of both the Eastern and Western hemispheres: China, Japan, South America, India, and the British Colonies all contributed to the excellent balance-sheet. In Africa and Australia particularly they had found things very much improved. In fact, in Africa, it was the best year they had had since the war, and, perhaps, better than any year before the war. In Australia they had also had a record with regard to profit. Australian business was not very profitable, but last year had been the best in the history of the Australian house, which had been in existence 15 or 18 years. The one fly in the ointment was Canada, which was not entirely satisfactory to their cable business. There was a great deal of business there which they were unable to do, for they could not accept the conditions which were creeping into the municipal contracts in that great Dominion. Some few years ago he mentioned at a general meeting certain unfair clauses which were put into municipal contracts in this country, but he was glad to say these had been very largely removed. The principal objection which he had to the conditions in the municipal contracts which were fixed by Canada, was the clause in which they would put the company's reputation as contractors, and their contract money, entirely at the disposal of the engineer who had to supervise the contract. He had within the last few weeks, with the concurrence of the board, refused a tender for important cable work in Canada, because they felt they could not accept the conditions of contract which did not provide for any arbitration. He would like to give one instance of the difference between dealing with the methods adopted by English houses and those who got their methods largely from the United States. Four or five weeks ago he took an order for £20,000 of cable from an English house, and he asked who should draw the contract. The answer was, "We do not want any contract; we are dealing with a reputable firm, and are quite satisfied to leave the matter to you." That was an instance of the confidence which existed between two British traders, and it was very different from what they had to meet with in regard to Canadian municipality contracts. He did not think there was any harm in his drawing attention to this matter, because it could do Henley's no harm. They would never tender for such contracts, and so would lose nothing in drawing attention to a clause which they thought was unfair and unjust to the British manufacturer. The chairman referred to the increased profits of last year, and he would like to say one word as to that. The profits were due very largely to the fact that they carried large stocks all over the world, and those stocks were made when the price of rubber was low. They knew what had happened with regard to rubber in the last few months, and he wanted to show that they had been selling the old stocks at a higher price. Those stocks had now to be replaced with rubber at higher price. They did not speculate, and did not buy rubber ahead. At that time they were buying rubber as they wanted it. They did not consider it their business as manufacturers to gamble in materials, and the result was that their old stock was now being replaced with rubber costing 50 or 100 per cent. more. The whole of their profits in the last year were not shown in the accounts, because in view of the difficult position of the rubber market some provision had to be made for the future. He had been asked more than once how it was if competition was so keen in the electrical industry, and especially in the cable trade, they were able to pay 15 per cent. on their capital. As a matter of fact, they did not do so. They paid 4½ per cent. on £350,000, and on £200,000 which they had in the reserve fund they paid nothing at all. It was on the £200,000 ordinary shares that they paid 15 per cent., and as a matter of fact, on the whole of the capital they paid about 6 per cent., which was not a large return for an industrial company. It was possible to pay 15 per cent. on the ordinary capital, because of the careful and proper way in which the finances of the company had been handled in the past. It was important that customers of the company should know that they were not rocking them to the extent of 15 per cent.

Mr. Finch, a director, spoke of the state of company's works at Woolwich and Gravesend, and said they were second to no other works.

The report was adopted, and on the motion of Sir Wm. Bell, a vote of thanks was accorded the board and the staff.

At the conclusion of the business proceedings, the Chairman said that as they knew a year ago it was decided to make a presentation to Mr. Sutton, and a committee of the board and the shareholders had commissioned Sir Luke Fildes to paint Mr. Sutton's portrait; whilst Mr. and Mrs. Sutton had been invited to themselves choose a service of plate. The chairman proceeded to speak in high terms of Mr. Sutton's services to the company. He joined the company as secretary 30 years ago, and after Mr. Henley's death, was appointed managing director.

Mr. Drysdale, on behalf of the shareholders, and Mr. Potter, on behalf of the staff, having spoken,

The portrait was unveiled, and Mr. Sutton was asked to accept the painting and the service of plate.

Mr. Sutton, who met with a very cordial reception, returned his sincere thanks for the honour done him, and said he could not stand up without referring to one of the staff with whom he had been associated for 25 years without hitch or disagreement—he referred to Mr. Hatton, of the North Woolwich Works. In 1882 they had 100 employés, and now they had 1,200. The dividends received by the shareholders amounted in round figures to £500,000, and they had spent £1,500,000 in wages in producing that sum. In conclusion, he asked the board to accept the portrait so that it might be hung in the board room.

County of London Electric Supply Co., Ltd.

The directors report that the capital expended during the year ended December 31st, 1909, on account of the company's London districts amounted to £57,026, making the net total expenditure therein £1,703,959. Including £3,645 brought forward, and £104,727, the balance from revenue account, after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, the total available revenue for 1909 is £108,373. From this are deducted interest on the first and second debenture stock (including interest on the further debenture stock issued in July, 1909) and interest on temporary loans to December 31st, 1909, less income-tax, £39,579; interim dividend on 55,000 6 per cent. preference shares for June half-year, less adjustment in respect of balance of last issue, less income-tax, £15,226; interim dividend on 40,000 ordinary shares at 4 per cent. per annum for June half-year, less income-tax, £7,567; carried to reserve for depreciation, repairs, renewals, &c., £16,000; leaving for further distribution, £30,001. There are now recommended the further half-year's dividend on the preference shares, and a further dividend on ordinary shares for the half-year ended December 31st, 1909, at the rate of 6 per cent. per annum, less income-tax, absorbing £26,837, leaving £3,163 to be carried forward. The profits derived from the company's London stations for 1909 amounted to £122,576, against £115,095 for 1908, being an increase of over 6½ per cent. The total applications received at December 31st amounted to the equivalent of 1,192,583 30-watt lamps (35,777 kw.), being an increase of 107,391 30-watt lamps (3,221 kw.) for the year, as compared with an increase of 84,021 30-watt lamps (2,521 kw.) for 1908. The total units sold were 14,736,109, as against 13,610,760 for the previous year, being an increase of 1,125,349 units, or over 8 per cent. An issue of £50,000 4½ per cent. first debenture stock and £50,000 4½ per cent. second debenture stock has been made, and the balance due on the last issue of 6 per cent. cumulative preference shares has been received. These moneys have more than sufficed to meet the capital expenditure during the year. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares of that company at the rate of 6 per cent. per annum, making 5½ per cent. for the year. The business of the Coatbridge and Airdrie Electric Supply Co., Ltd., has again made good progress during the year. There is an increase of 716 kw. applied for, and an increase of 413,166 in the units sold during the year, raising the total sales to over 2,000,000 units. Under the powers conferred by the London Electric Supply Act, 1908, steps are being taken to connect up the company's northern and southern districts.

Units generated	19,791,379
Sold to private consumers by meter	14,736,109
Used on works	1,184,860
Total accounted for	15,920,969
Not accounted for	3,870,420
Total max. supply demanded, kw.	9,850

Charing Cross, West End and City Electricity Co., Ltd.

Mr. W. F. Fladgate, chairman, presided on Thursday, March 3rd, over the annual general meeting of the above company held at the offices, St. Martin's Lane.

The Chairman said he would premise his remarks by saying that in the view of the board the working of the past year had been satisfactory. Their gross earnings had amounted to £142,431, as compared with £139,253 for 1908. This was the actual cash they had received, notwithstanding the coming of the metal-filament lamp; the energy which was sold for power and heating purposes was greater than in the preceding year. As against this their expenses amounted to £90,252, against £87,785. The results of the two years' working was, therefore, practically the same. The net earnings for 1909 were £52,179, against £51,467 for 1908, and they would pay 5 per cent. for the year—the same as last year. During the year they had connected on their mains an increase of 33,897 lamps, but the amount they were selling for power was gradually increasing, as against the amount they were selling for lighting, and that was one of the reasons why the amount of their gross earnings was not increasing in the way they would like. Of the increase in the last year, no less than 50 per cent. was for power, and only 50 per cent. for lighting. Still keeping to the West-end account, it would be seen that their share capital remained the same as last year, but their loan capital was £70,000 less. The City undertaking had repaid £120,000, and out of this the West-end Co. had paid off temporary loans to the extent of £70,000. With regard to capital expenditure, the only two items to which attention need be called were £8,782 for land and buildings, and £36,421 for machinery, these two considerable items having been necessitated by their Short's Garden station and enabling them to replace the Lambeth station. They hoped to be able to close down the

Lambeth station for the six summer months, by which they trusted they would save a considerable amount of expense, but they could not shut it down entirely during next winter, because the load was so much increased that, until their other stations were fully equipped and ready to take the load, they did not consider it safe to shut down Lambeth. On the revenue account, the figures were very similar to those of 1908. With regard to the balance-sheet, the advances to the City undertaking had been decreased by £120,000, and the total reserves now came to £236,185. The losses on transmission were slightly less, viz., 33·1 per cent., against 34·1 per cent. They looked upon the progress of the City undertaking as satisfactory. Their gross earnings had increased from £131,012 to £139,186, while the expenses had increased from £76 561 to £82,628, and the net earnings were £56,558, against £54,450. After payment of the interest on the debentures and loans, there was a balance to net revenue of £31,288, out of which they paid a dividend on the preference shares, amounting to £18,000, and brought forward £13,289. They looked on the City undertaking now as fairly paying its way. The connections in the city for the year had amounted to 37,993 lamps, but no less than 78 per cent. were for power, and only 25 per cent. for lighting. The share capital account of the City undertaking was the same, and the loan capital was now consolidated. Last year they carried out the operation by paying off their debenture bonds, and a certain amount of the temporary debt, by the creation of £600,000 4½ per cent. debenture stock; and consequently they had only to pay 4½ per cent., against 5 per cent. The auditors had made a note with regard to the fact that they had not dealt with depreciation, but they had not done so, because, having regard to the terms of their Provisional Order, it did not seem to them to be necessary to do so. The losses on transmission were a little bit better this year, and amounted to 28·4 per cent. against 31·8 per cent. They had sold 3,000,000 more units of energy, and they might wonder why the net earnings were not greater. He was informed by the staff that the loss of sales caused by the use of the metal-filament lamp were not less than £10,000, and the staff also thought that for all practical purposes they had got half way through their troubles. He did not, however, think that the advent of the lamp was by any means an unmixed curse, as he believed it would tend to popularise the use of electric light and would benefit them in the future. The other reason why the earnings were not so great was, of course, that there was not so much profit on the sale of power, which had now become a very large item in their business. He noticed that other companies who adopted a flat rate of 1d. per unit, were suggesting increasing their charge. That company never went down to a flat rate of 1d., because they did not think it advisable, and did not believe it could be maintained, and they were not surprised to hear that other companies had to increase. Luckily, against the decrease in profits, he was glad to say they were making headway by economies and careful management. The cost per kilowatt-hour for energy generated showed a reduction in 1909 as against 1908 by no less than 10 per cent. Their anticipations of economy by the use of oil as fuel had been fulfilled, and they were going to continue the policy in replacing the Lambeth station. They were arriving at the end of the first decade of this century, and it might not be uninteresting to refer briefly to the progress which had been made since 1900, which was when they began their work in the City. They undertook that extension because they believed that the success of electric light companies would rest with producing energy at the smallest possible price and selling it over the largest area; so that, starting with a small area in St. Martin's they took other areas to the west, and then came into the City. In 1900 the company supplied 220 000 lamps, practically all of which were for lighting. Now they were supplying 613,000 lamps in the West End, but of these the equivalent in lighting was only 430,000, and in the City they were supplying 534,000 lamps, of which no less than 200,000 were for power. It cost them 50 per cent. less now to produce energy than in 1900, but the average selling price was 45 per cent. less. In conclusion, the chairman referred to the Electric Lighting Act of last year, and said he thought they wanted statutory powers under it to enable them to do much. Some of the companies were seeing what could be done, and he was glad to say they were being joined by the Borough Councils. A committee, composed of the representatives of the company and the Borough Councils, had been sitting, and they were employing their engineers to consider how far a joint scheme could be promulgated.

Mr. G. B Glasier seconded the motion.

Mr. Theodore Rich said he wished to raise one question, but in doing so he hoped it would not be inferred that he had any axe to grind, because he had not. He understood that during 10 years practically every scrap of machinery used by the company had been made abroad. He was told that the reason was because a considerable amount of difficulty was experienced with the machinery made in this country at the Lambeth station. He believed it had been the practice to put a practical monopoly into the hands of one firm, and that a foreign firm. He and several of his friends who were interested in the company were much opposed to that, and he believed the practice had given rise to a great deal of criticism in the electrical trade. He asked the chairman whether, in any extensions which might take place, and he understood there would be such, the company would give equal facilities to British firms, which, all over the country, had shown themselves capable of turning out good work. He asked that in future English firms should be given fair and reasonable facilities for supplying machinery. If there were any arrangements between the company and any foreign banking firm which made it necessary to put this work abroad, then the shareholders ought to hear about it.

The Chairman: There are no financial arrangements of any sort or kind by this company which ties us to any foreign or any English company. As regards the question of employing English or foreign manufacturers, facilities are given for the employment of English manufacturers.

Mr. Rich: Many firms have not had an opportunity of tendering.

The Chairman: They have had the opportunity, but we find by experience that we are better served, and more cheaply served, than we can be in this country. As to cables, only one set have been of German manufacture.

Mr. Rich: I was not talking about cables.

The Chairman: We are in no way tied, and it is not true that we are not giving facilities to the English manufacturer. We are very glad to hear any suggestions shareholders may make and they will have the careful consideration of the board.

Mr. Rich: I think there are a number of large manufacturers in this country who for some time have never had facilities.

The Chairman: The engineer does not agree with that, but it is a matter of detail which I will not discuss at the meeting.

The report was then adopted, and subsequently the retiring directors were re-elected, and a vote of thanks was passed to the staff.

Lancashire United Tramways, Ltd.

The directors' report states that the profit for the year amounts to £15,472, and after paying the prior lien debenture stock interest there is a credit of £2,972, which has been carried to depreciation account. The following is a summary of the operations of the various tramways (including the dividend received from St. Helens tramways), which are comprised in the company's system, worked out as though they were one combined undertaking. Traffic receipts, £68,200; miscellaneous receipts, £3,374 = £71,574; less working expenses, £46,554; general charges (including direction, management, interest, &c.), £4,785; rents of leased lines, &c., £4,961 = £56,300, leaving £15,274 as the profit of combined undertaking. The above receipts show a decrease of £407 compared with the previous year, and the expenses have increased by £854. The receipts per car-mile amounted to 7·62d., against 7·70d. last year. The decrease in traffic receipts occurred wholly at week ends, and was due to the inclement weather experienced during the year; the decrease in respect of Sunday traffic alone was £1,004. The increase in expenses is largely due to the additional mileage run. The contract for advertising on cars having terminated in April last, the directors decided that the company should manage its own advertising, and the results obtained so far have justified their decision. It is confidently expected that the receipts from this source will, in future years, bring in an increased income. The sum of £920 less tax, was received as dividend on the company's holding in the new St. Helens and District Tramways Co., Ltd. Since June last, through running arrangements with the Bolton Corporation have been in operation, and have proved of great convenience to the travelling public, with satisfactory results to the company. The directors hope to induce other connecting systems to enter into similar mutual arrangements.

The fifth ordinary general meeting of this company was held on February 25th, the Hon. Arthur Stanley, M.P., presiding.

In moving the adoption of the above report, the Chairman said it would be seen that the profit for the year amounted to £15,274, and after paying the prior lien debenture stock interest there was a credit of £2,972, which had been carried to the depreciation fund, which was commenced last year with a sum of £1,904, making that fund £4,876. The results of the year had, unfortunately, been affected by the inclement weather, and they had also suffered from the bad state of trade in Lancashire. The total combined receipts showed a reduction of £407 as compared with the previous year, and the expenses had increased by £854. They showed a reduction of no less than £1,004 on their Sunday traffic, which was mainly due to bad weather. There were, however, some gratifying features in the report. They had carried 3,660,000 workmen, as compared with 2,191,000 in the previous year. They had been successful, after considerable negotiations, in entering into an agreement with the Bolton Corporation for the through running of cars, and since the scheme had been in operation—June 14th, 1909—there had been an increase of 220,000 in the number of passengers carried. In connection with the arrangement, however, they had had to increase their mileage by 11,000 miles in order to adjust themselves to the service of the Bolton Corporation. The increased expenditure was caused by the renewals of tramlines, £1,000, which had been charged to revenue account, the reconstruction of a cooling tower, and the replacing of a considerable quantity of grit paving for granite. Their expenses per car mile, not including capital charges, were less than 5½d., notwithstanding the fact that they provided the whole of the street lighting through which the cars ran. The supply for power to outside consumers had increased from 153,000 units to 233,000 units. The company was otherwise in a satisfactory financial state, and given a better summer, and an early discontinuance of the present inclement weather, the directors looked forward to an improved state of affairs.

Mr. J. S. Austen seconded the motion, and the report was adopted.

Rubber Plantations Investment Trust, Ltd.—At an extraordinary general meeting held in the City last week, a resolution was passed increasing the capital of the company to £1,000,000 by the issue of 500,000 new shares of £1 each.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc
Aberdeen	Mar. 2	2,420	+ 54	39	53,763	— 229	..	..
Ayr	,, 5	864	+ 33	42	14,121	— 126	8	..
Bath	,, 5	1,279	+ 175	9	5,870	+ 604	..	..
Belfast	,, 4	7,488	+ 573	47	184,426	+ 7,121	37	..
Birkenhead	,, 6	2,683	+ 224	48	51,895	+ 231	13·63	..
Birmingham Corp.	Feb. 26	13,534	+1,182	48	317,767	+12,779	56·39	..
Blackburn	Mar. 2	1,851	+ 89	48½	52,183	— 1,433	14·12	..
Blackpool Corp.	,, 3	886	+ 92	..	53,864	+ 4,492	..	..
Blackpool-Fleetw'd	,, 5	521	+ 44	9	2,025	— 122	..	..
†Bolton	Feb. 27	2,172	+ 216	48	110,497	+ 1,026	26	..
Bournemouth	Mar. 2	2,760	+ 342	48	78,618	+ 1,739	21·95	..
Bradford	Feb. 26	9,328	+ 754	47	229,•81	+ 9,376	54·81	..
Brighton	Mar. 6	1,547	+ 323	48½	45,947	+ 2,429	9·5	..
Bristol	,, 4	10,433	+1,410	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Feb. 25	429	+ 5	8	1,729	+ 32	3·65	..
Barnsley	,, 25	258	+ 29	,,	1,917	+ 35	..	..
Barrow	,, 25	453	+ 33	,,	1,736	+ 148	5·37	..
Cavehill	,, 25	101	— 13	,,	405	— 27	..	..
Devonport	,, 25	742	+ 112	,,	3,198	+ 167	8·85	..
Gateshead	,, 25	1,916	— 27	,,	7,490	— 137	11·25	..
Gravesend	,, 25	367	+ 26	,,	1,440	+ 70	6·5	..
Greenock	,, 25	1,002	+ 130	,,	3,832	+ 429	7·25	..
Hartlepool	,, 25	392	+ 24	,,	1,577	+ 53	6·72	..
Kidderminster	,, 25	165	+ 16	,,	641	+ 28	..	..
Leamington	,, 25	279	+ 21	,,	1,024	+ 8	..	..
Merthyr	,, 25	366	— 9	,,	1,459	— 86	2·9	..
Metropolitan	,, 25	12,784	+2,514	,,	50,331	+ 8,529	22	..
Middleton	,, 25	514	— 68	,,	1,995	— 249	8·5	..
Mid. Joint Com'tee	,, 25	10,•96	+ 617	,,	42,160	+ 1,997	..	..
Oldham—Ashton	,, 25	1,007	— 38	,,	3,925	— 145	9·13	..
Peterborough	,, 25	188	+ 11	,,	747	+ 25	5·31	..
Potteries	,, 25	3,374	— 2	,,	13,385	— 190	29	..
Rothesay	,, 25	73	+ 9	,,	334	+ 2	2·75	..
Southport	,, 25	452	+ 29	,,	1,684	— 43	8·17	..
S. Metropolitan	,, 25	1,336	+ 88	,,	5,423	+ 249	..	..
Swansea	,, 25	1,855	+ 227	,,	7,539	+ 856	12·5	..
Tynemouth	,, 25	263	+ 7	,,	1,082	+ 83	3·75	..
Weston-s Mare	,, 25	44	— 7	,,	197	— 8	3	..
‡Worcester	,, 25	446	+ 33	,,	1,833	+ 60	5·75	..
Wrexham	,, 25	165	— 5	,,	671	— 26	..	..
Yorks. Wool. Dist.	,, 25	1,894	+ 249	,,	7,201	+ 594	17	..
Miscellaneous	,, 25	370	+ 16	,,	1,469	+ 66	..	..
Burnley	Mar. 5	2,348	+ 221	..	..	..	..	..
Burton-on-Trent	,, 6	495	+ 15	49	12,856	— 38	6·62	..
Bury	,, 6	2,199	+ 324	48½	55,413	+ 25	22·5	..
†Cardiff	,, 5	2,067	+ 240	49	106,531	+ 2,771	..	..
Carlisle	,, 5	292	+ 30	9	1,•37	+ 30	..	..
Chatham and Dist.	,, 3	1,503	+ 337	9	6,612	+ 532	14·98	..
Cork	,, 8	828	+ 54	..	3,756	+ 100	9·89	..
Croydon	..	..	..	..	..	..	..	..
†Darlington	Feb. 26	175	— 3	48	8,804	— 503	..	..
Darwen	Mar. 4	434	+ 20	48	11,820	— 113	4·86	..
†Dover	Feb. 26	163	+ 34	48	9,742	— 201	4·75	..
Dublin	Mar. 4	9,628	+ 686	..	39,384	+ 745	54·25	..
Dundee	,, 2	2,238	+ 31	41½	49,009	— 740	15·5	..
East Ham	,, 5	1,941	+ 368	48½	48,396	+ 5,628	8·52	·77
Exeter	,, 4	523	+ 50	49	15,756	+ 777	5·5	..
Glasgow	,, 5	34,188	+2,643	..	670,588	— 4,464	94½	5
Hastings	,, 3	1,454	+ 487	..	..	..	..	..
Huddersfield	Feb. 26	3,249	+ 400	47	74,392	+ 4,636	28·5	·5
Hull	Mar. 5	5,381	+ 766	48	127,310	+ 7,015	14·5	1·5
Ilkeston	,, 3	244	+ 8	48	6,592	+ 239	..	..
Ipswich	,, 5	666	+ 116	49	18,953	+ 473	10·5	..
†Kilmarnock	,, 5	143	+ 21	42	6,108	— 211	4·26	..
Lancashire United	,, 2	2,864	+ 55	..	10 289	+ 90	39	..
†Leeds	Feb. 26	6,474	+ 473	47	321,698	+11,090	..	..
Leicester	..	..	..	..	..	..	..	..
†Leith	Mar. 5	553	+ 103	42½	24,918	+ 2,911	9	3
Liverpool	Feb. 26	20,747	+ €60	8†	85,341	+ 1,613	109·5	2
‡L.C.C.	,, 19	76,313	+10,928	..	1,741,009	+119,914	129·5	6⅞
London United	Mar. 5	10,813	+2,149	..	48,160	+ 4,406	..	..
†Lowestoft	Feb. 26	186	+ 31	22	3,350	+ 196	3·5	..
Manchester	Mar. 5	29,•68	+2,700	49	722,751	+ 2,284	183	1
Newcastle	,, 5	7,405	— 180	..	188,626	— 1,302	14·5	..
Newport	,, 5	1,282	+ 196	49	31,796	+ 288	14·5	..
Oldham	,, 6	3,800	+ 250	49	87,679	— 7,088	23·75	..
†Pontypridd	Feb. 26	858	+ 17	47½	19,314	+ 1,223	5·5	..
†Portsmouth	,, 26	1,559	+ 187	48	96,471	+ 3,749	14·5	·75
Preston	Mar. 2	1,342	+ 84	..	..	..	..	..
Rotherham	,, 3	1,060	— 25	44	26,087	— 992	12	2
Salford	Feb. 28	8,718	+ 562	46⅝	216,203	— 2,648	..	..
Sheffield	Mar. 6	11,686	+1,780	49½	280,541	+ 8,044	39·62	2·62
†Southampton	,, 2	961	+ 152	48	50,999	+ 513	..	..
Southend-on-Sea	,, 2	745	+ 215	48	24,315	+ 3,515	..	..
South Shields	,, 5	1,000	+ 32	48½	27,009	+ 125	..	..
Swindon	..	..	..	..	..	..	..	..
Tyneside	,, 2	704	— 43	9	3,032	— 279	..	..
Wallasey	,, 5	1,571	+ 62	48½	48,814	+ 903	..	..
Walthamstow	,, 5	1,088	+ 263	49	31,433	+ 1,578	9	..
West Ham	Feb. 24	4,500	+ 460	47½	110,738	+ 7,495	16·25	..
Wolverhampton	Mar. 2	1,725	+ 429	48	41,028	+ 2,047	13·8	1·75
Baker St.-Waterloo	,, 5	6,985	+ 65	9	31.425	+ 415	4·25	..
Cen. London Rly.	,, 5	11,258	+ 41	9	50,167	— 569	6·32	·55
Char. +, Eus. Hamp.	,, 5	7,675	+ 160	9	34,505	+ 50	7·75	..
City & S. Lon. Rly.	,, 6	5,803	— 231	9	30,947	— 635	7·3	..
Dublin-Lucan Rly.	,, 4	210	+ 5	9	902	— 65	7	..
G.N. and City Rly.	,, 5	3,052	— 142	9	14,093	— 334	3.5	..
G.N., P'ty. & Brmin.	,, 5	12,570	+ 915	9	55,565	+ 2,535	9·25	..
L'pool Overh'd Rly.	,, 6	2,545	+ 70	..	12,799	— 189	6·8	4·8
†Llandudno-Col. Bay	,, 4	199	+ 28	13½	1,556	+ 130	..	..
Mersey Railway	,, 5	3,934	+ 183	9	17,824	+ 254	4·5	..
Metropolitan Rly.	,, 6	82,304	+ 659	..	148 038	+ 5,056	24·5	..
Met. District Rly.	,, 5	22,215	+3,010	9	97,468	+ 9,078	24	..
Anglo-Argentine	,, 4	85,892	+6,462	..	382,760	+31,827	..	..
§Auckland	Feb.	14,577	+ 790	..	..	..	22·3	1·38
Bombay (B.E.T.)	,, 4	5,285	+ 377	5	13,023	+ 944	..	..
§Brisbane	,,	15,760	+1,984	8	32,840	+ 3,714	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Mar. 5	7,389	+ 516	8	29,549	+ 1,381	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Jan.	3,172	..	..	3,172	..	20·5	..
Madras	Feb. 28	1,118	+ 106	..	5,354	+ 207	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Mar. 4	3,139	+ 212	..	14,423	+ 803	28	

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Activity is buoyant in most of the speculative departments round the Stock Exchange. The spirit of speculation is very much in the air, and present appearances point to the Stock Exchange having a lively time for a few months to come. It is really only amongst purely investment sections that business is of humdrum character.

Home Railway stocks move by spasmodic spurts. Last week it was the Central London issues that featured the market by substantial rises. This week, Metropolitans and Districts take the lead, the former especially being strong, but Districts gaining a point, while Central London Ordinary went back 3. The senior Undergrounds advanced on Exhibition prospects, and Central Londons gave way as holders came forward to take advantage of the comparatively big rise, to get out of their stock. Moreover, there is a hint that another capital issue may have to be made in order to build the extension to Liverpool Street.

Traction descriptions, apart from the railway stocks, are quiet. Anglo-Argentine Tramways 4 per cent. Debenture is ½ down, and Calcutta Trams continue to dwindle. The rise in Metropolitan Electric Tramways Debenture has made further progress, and Underground Electric Railway Income bonds hardened 1 in sympathy with the rise in Districts. A new issue of some importance is that of £350,000 Extension Mortgage 5 per cent. Debentures, at 90, by the Buenos Ayres Lacroze Tramways Company. According to the figures given in the prospectus, the interest is amply secured. There is at the present time an issue of rather less than half-a-million sterling Buenos Ayres Lacroze Trams 5 per cent. First Mortgage Debenture stock quoted at 97 to par.

Mexico Trams and the bonds are rather less firm, but Rio Trams rose 1 to 98. Shawinigan Water stock declined to 106, and the 5 per cent. bonds fell to 108. Toronto 4½ per cent. bonds have been bought at 101⅝ this week, and Winnipeg Electric 4½ per cent. Consolidated Debenture stock at 105½. Metropolitan Electric Trams Deferred changed hands on Monday at 1s. 6d. and 1s. 3d.

The mention of new issues leads, of course, straight to the rubber market, which is still one of the leaders of speculative animation in the Stock Exchange. That its abounding vitality has been somewhat checked by a furious gamble that broke out in Rhodesian mining shares is considered in the market as no more than a temporary incident, and certainly the prices are good enough. Dividend prospects are a topic for prophetic discussion, and the estimates range from 50 to 400 per cent. on shares in the big companies, in whose case the florin denomination has been adopted. It would appear that the rubber boom rested only to gather fresh fervour for a further rise, and the possibilities point to resumption of the bull campaign based on the record prices obtained this week at the Mincing Lane sales for the raw product.

Movements amongst the prices of Electricity Supply issues are almost uniformly favourable to proprietors, and the list shows a sprinkling of useful rises. County of London responded, if tardily, to the dividend announcement with a 5s. gain, and City's rose to 12⅜, this being the third consecutive week in which the price has moved upwards. Chelseas went up 7s. 6d. Metropolitans recovered their set-back, and the Edmundson's Urban shares are better. The Mexican lighting companies' descriptions are steady. Victoria Falls Power Preference rose 1/32, thanks to the revival in Rhodesian shares already mentioned. Bournemouth and Poole remain at 9½, in spite of the reduction in the dividend.

Telegraph stocks and shares are, on the whole, strong and disposed to improve. The feature is a good rise in Anglo-American Telegraph Preferred stock, which has gained 2⅜. It is, of course, a speculative investment, the attractions of which have been pointed out on various occasions here. Anglo Ordinary and Deferred are also better. As a curiosity it is worth noticing that Eastern Extensions rose while Eastern Ordinary did not move. Great Northern Telegraphs and Indo-Europeans have improved. Westerns shaded off. West India and Panama Second Preference are 10s. to the good. Direct Spanish Telegraphs are unchanged on the issue of a somewhat disappointing report.

Marconi's are a trifle easier, and so are Oriental Telephone Ordinary shares. In the National Telephone group there has occurred no alteration. Manufacturing shares are quiet. Dick, Kerrs went back to a little under a sovereign. Edison & Swan "A" shares, rising to half-a-crown, made a stride of no less than 33 per cent. on their previous quotation. Babcocks remain in considerable public demand, and a further rise has taken Henley's to 13½ middle.

Ibbotson Bros. & Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. for the half-year to December 31st.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations March 1st.	Closing Quotations March 8th.	Business done week ended March 8th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
												£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	Nil.
116,203	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$25,.96,600	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	144 —146	144 —146	..	..	..	6 9 7
$68,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 68,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	..	..	..	4 3 4
558,460	Anglo-American Telegraph	Stock	3¾%	3¼%	£3 4s.	3⅜%	58½ — 60½	59 — 61	58½	..	+ ½	6 0 5
3,220,770	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	6 %	99⅝ —100½	102½—103½	103	100⅝	+2½	b 15 11
3,220,770	Do. do. do. Deferred	Stock	12½%	1 %	8/-	25/-	18¾ — 19½	19¼ — 19⅝	19½	18⅝	+ ¼	6 9 0
47,735	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½ —101½ xd	99⅜ —101½	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅛ — 8 1/16	7⅛ — 8 1/16	..	..	..	4 16 8
2,449,176	Commercial Cable, Being 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	86½ — 88½	87 — 89	88½	87½	+ ½	4 9 11
16,000	Cuba Telegraph	10	5 %	6 %	6 %	..	8¼ — 9½	8¼ — 9½	..	..	..	6 9 9
5,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 12 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3 — 3½	3 — 3½	..	..	..	5 14 3
5,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	20	4½%	4½%	4½%	..	13½ — 14½	13½ — 14½	14½	13½	+ ½	5 19 1
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½ —101½	100 —102	..	..	+ ½	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	185 —188	184½ —187½	186	184½	— ½	5 1 10
2,000,000	Do. 5% Pref. Stock	100	5%	5%	5%	5%	86 — 88	86 — 88	86	85⅞	..	4 1 5
1,898,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½ —104½	102½ —104½	104	..	..	3 16 7
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	12⅝ — 13⅛	12⅝ — 13⅛	13 1/16	12⅞	+ ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 5,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 3
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10½ — 11	10¾ — 11	10⅞	10½	..	5 4 7
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13½ — 13⅝	13½ — 13⅝	13 1/16	13 1/16	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen	10	20 %	20 %	18 %	..	30 — 31	30½ — 31½	30⅝	..	+ ½	5 9 1
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99½ —101½	100 —102	..	..	+ ½	4 8 3
17,000	Indo-European Telegraph	25	12 %	12 %	12 %	..	52 — 54	53 — 55	55	53	+ 1	6 14 4
£41,880,400	Mackay Companies Common	$100	4 %	4 %	4 %	4½%	92 — 94	92 — 94	..	..	..	4 10 5
£50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 82	80 — 83	..	..	+ 1	4 16 5
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3½ — 3⅝	3½ — 3⅝	..	..	— ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	⅞ — 1	1 — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝ — ¾	⅝ — ¾	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104½ —106 xd	104⅝ —106	104⅞	104	..	5 13 2
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½ —125½	124⅛ —125½	124⅝	124	..	4 15 7
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10⅝ — 10⅞	10⅝ — 11⅛	10⅞	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅛	10 — 10⅛	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5 3/16 — 5⅜	5 5/16	5 1/16	..	4 8 11
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½%	98 —100	98 —100	..	..	..	3 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	..	1⅜ — 1½	1 11/16 — 1 13/16	26/10½	..	—3½	5 6 1
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 7/16	23/9	..	..	4 14 9
196,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,889	Reuter's	5	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	7 15/16	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	102	..	..	4 8 3
3,042	Submarine Cables Trust	Certs.	6 %	6 %	6 %	..	130 —133	130 —133	..	..	..	4 10 3
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7⅞ — 7 15/16	7⅞ — 7 15/16	7 15/16	7⅞	..	5 7 9
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 8 11
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 10 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14½	13⅜ — 14½	14	..	— ⅛	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1 15/16 — 2 1/16	1 15/16 — 2 1/16	18,6	17/-	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	..	9 — 9¼	8½ — 9½	8 15/16	8 13/16	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8 — 9	8⅞ — 9⅛	9⅛	..	+ ⅛	6 6 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,600	100	5 %	5 %	5 %	5 %	100⅛ —102½	100⅛ —102½	..	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	5 %	4½ — 4⅝	4½ — 4⅝	92/6	90/-	..	5 5 5
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	5 %	4⅜ — 4⅝	4⅜ — 4⅝	85/7½	..	..	5 14 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ — 92	90 — 91½	91	90½	— ½	4 7 5
382,887	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
380,000	Babcock & Wilcox, 1 to 380,000	1	20 %	20 %	20 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	5⅛	+ 1/16	3 16 2
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	½ — ⅝	½ — ⅝	12/6	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	1 — 1⅛	1 — 1⅛	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	..	2½ — 3½	2½ — 3½	..	..	..	..
12,897	Do. do. 4 % Funding Certs. ..	5	4 %	4 %	2 %	..	⅜ — ⅝	⅜ — ⅝	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	95 — 98	95 — 98	..	..	..	..
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	8 %	8 %	8 %	139 —143	140 —144	142	..	+1	5 11 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	118 —122	118 —122	120½	..	..	4 18 4
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —112	110½ -112½	112	111½	+ ½	4 8 11
293,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	20/-	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	..	2⅜ — 2½	2⅜ — 3⅛	..	..	— ⅛	4 16 0
1,479,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93	92	90	..	5 7 6
598,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	68 — 73	..	..	..	6 6 8
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	..	7⅜ — 7⅝	7⅜ — 7⅝	7 11/16	7 3/16	+ 1/16	6 7 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	4 10 7
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
304,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	87 — 92	87 — 92	..	..	..	4 17 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	7/16 — ½	7/16 — ½	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	49	..	..	7 16 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	¾ — 1 1/16	¾ — 1 1/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
135,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44 xd	39 — 44	41	..	..	10 4 6
135,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	4½%	..	4⅛ — 4⅜	4 — 4½	88/9	82/6	— ⅛	5 0 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10½ — 11	10½ — 11	..	..	..	6 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 5½	5⅜ — 5½	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	4 6 2
491,223	Cape E. Trams., 1 to 491,223	1	Nil	Nil	Nil	..	1/16 — ⅛	1/16 — ⅛	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅜ — 2½	2⅜ — 2½	49/-	48/9	..	5 0 0
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	107	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	71 — 73	68 — 70	72½	68½	—3	4 5 9
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86½	65½	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	51 — 53	51 — 53	54½	52	..	3 15 6
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	30 — 31	30 — 31	30⅝	30	..	5 12 11
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully pa

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations March 1st,	Closing Quotations March 8th.	Business done week ended March 8th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
250,000	Dick, Kerr & Co., 1 to 250,000	1	10 %	10 %	6 %	..	3/32 — 1/32	1/16 — 1/32	..	..	— 1/32	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 9 1
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½ %	2½ %	Nil	..	1/32 — 1/32	1/16 — 1/16	..	..	+ 1/32	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½ %	2½ %	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	..	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/4 — 3/4	1/4 — 3/4	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1½ — 1⅝	1½ — 1⅝	..	..	..	10 4 0
95,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 3
210,000	Do. do 4 % Mort Deb. ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	1½ %	Nil	..	3/8 — 7/8	3/8 — 7/8	..	..	..	Nil
98,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 — 103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	5 %	15%	15 %	15 %	13 — 13⅜	13⅛ — 13⅞	13⅜	13⅛	+ ⅛	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5 1/16 — 5 1/16 xd	5 1/16 — 5 1/16	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105½ —107⅛	105½ —107⅛	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	0 %	10 %	10 %	10 %	15⅞ — 16	15⅞ — 16	15⅞	15¾	..	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½ %	Nil	Nil	1⅛ — 1⅞	1⅛ — 1⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4⅜ — 5¼	4⅜ — 5¼	..	..	..	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
999,980	Do. do. 50,008 to 100,000	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 6 % Cum. Pref., 1 to 125,000	10	5 %	5 %	83%	..	2⅛ — 2⅜	2⅛ — 2⅜	50/-	..	..	13 12 8
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	..	4 %	4 %	70 — 73	70 — 73	72	..	..	5 9 7
3,722,062	Metropolitan Consolidated	100	1 %	1½ %	1½ %	1 %	38⅛ — 39	41⅛ — 42	42⅜	39⅛	+3	2 7 7
2,640,914	Do. Surplus Lands	100	23⅛	23⅛	23⅛	23⅛	67 — 69	68 — 70	69⅛	68⅜	+1	3 18 7
3,335,000	Do. District	100	Nil	Nil	Nil	Nil	17⅛ — 17⅜	18⅛ — 18⅜	18⅝	17⅛	+1	Nil
891,327	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	⅛ — ¼	⅛ — ¼	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	..	3/32 — 1/8	3/32 — 1/8	1/6	1/8	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	3/32 — 1/8	3/32 — 1/8	..	..	..	5 14 8
595,500	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 98	96 — 99	97	95½	+1	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	182½ —184½	132 —134	133½	132⅜	— ½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	97½ — 99½	97½ — 99½	96½	95⅜	..	5 0 6
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	1/32 — 1/16	1/32 — 1/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	35½ — 37	35½ — 37	..	..	..	5 12 11
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	5 %	..	101⅛ —102⅛	101⅛ —102⅛	..	..	..	4 17 7
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	89 — 91	89 — 91	89	..	..	4 18 4
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 — 34	34 — 36	33	..	+2	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	..	1/32 — 1/16	1/32 — 1/16	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	6 %	1¼ — 2¼	1¾ — 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	..	4¼ — 4⅜	4¼ — 4⅜	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7⅜ — 8½	7⅜ — 8½	7⅞	7 1/16	..	6 1 3
9,551	Do do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½ — 7⅝	7½ — 7⅝	..	..	..	4 4 10
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	87/6	86/3	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8⅝ — 4⅝	8⅝ — 4⅝	78/1½	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96⅛ — 98⅛	96⅛ — 98⅛	98⅛	..	..	4 1 3
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅛ — 3⅜	3⅛ — 3⅜	..	..	+ ⅛	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	98 —101	99 —102	..	..	+1	4 8 3
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	12 — 14⅛	12⅜ — 12⅝	12 15/16	12 1/16	+ ⅛	5 9 10
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	13	..	..	4 10 7
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	122½	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	..	..	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅜ — 3⅜	2⅜ — 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	91 — 96	91 — 93	..	..	..	5 7 6
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛ — 8	7⅜ — 8⅛	8 1/16	7⅞	+ ⅛	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛	10⅜ — 11⅛	11 1/16	10 1/16	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	100⅛	..	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	Nil	Nil	Nil	..	1/32 — 3/32	3/32 — 3/32	..	..	+ 1/16	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1/8 — 1⅛	1 — 1½	..	..	+ ¼	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	70 — 73	70 — 73	..	..	..	6 3 3
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	79 — 82 xd	80 — 83	80½	80⅛	+1	6 0 6
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	6⅞ — 7⅛	7 — 7⅛	7⅛	7 1/16	+ ⅛	5 18 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½ —104½	102⅜ —104⅛	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	8 %	..	7½ — 7⅝	7½ — 7⅝	7⅜	..	..	5 3 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94⅛ — 96⅛	94⅛ — 96⅛	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	2½%	3 %	..	1½ — 2⅛	1⅞ — 2⅛	40/-	38/9	..	4 4 3
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	..	4⅛ — 5½	4⅛ — 5½	5 1/16	5⅛	..	5 14 3
882,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	..	..	+ ⅛	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	5 %	6½%	5 %	5 %	4¼ — 4⅜	4¼ — 4⅜	90/-	85/-	..	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5	4⅜ — 5	95/-	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	83 — 85	83½ — 85½	85	84⅛	+ ⅛	6 8 8
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	3½%	..	77⅛ — 79½	80 — 82	81	78⅛	+2⅛	4 5 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	105 —107	104 —106	106⅛	105⅛	—1	6 12 1
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	90⅛ — 91⅛	90⅜ — 91⅜	91⅜	90⅛	+ ⅛	5 9 0
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	4 — 4⅛	4 — 4⅛	..	..	..	2 11 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅛ — 5	4⅛ — 5	..	..	..	5 11 1
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 —101	99 — 101	100	99½	..	4 19 0
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12½ — 13½	12½ — 13½	..	..	..	5 1 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	..	7 %	6⅜ — 6⅞	6⅜ — 6⅞	..	..	..	3 16 9
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 5 4
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	2½%	6 %	8 %	..	1 1/16 — 1 1/32	1 1/32 — 1 1/16	37/6	36/6	+ 1/16	6 1 11
100,000	Do. do. 8% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/32 — 1 1/16	1 1/32 — 1 1/16	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102¼ —104¼	102¼ —104¼	..	..	..	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	10 %	10 %	10 %	10 %	8⅜ — 8 7/16 xd	8⅜ — 8⅝	..	..	..	5 12 8
40,000	Do. do. 7 % Pref. 20,061 to 40,060	5	7 %	7 %	7 %	7 %	6⅞ — 7 1/16 xd	6⅞ — 7⅛	..	..	+ ⅛	4 18 3
150,000	Do. do. 8½ % Deb. Stock Red. ..	100	8½%	8½%	8½%	8½%	83 — 87	83 — 87	..	..	..	4 0 6
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	2½%	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	9 6 1
120,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	60/-	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	7/32 — 9/32	7/32 — 9/32	..	..	..	4 8 11
142,988	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/32 — 1 1/16	1 1/32 — 1 1/16	..	..	..	5 15 6
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	3/32 — 1/8	3/32 — 1/8	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1½ — 1⅝	1½ — 2	35/-	..	+ ⅛	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	76 — 78	..	..	+ ½	5 15 5
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000 ..	1	..	..	5 %	..	17/32 — 9/16	17/32 — 9/16	18/1½	..	..	5 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅛ — 9 xd	8⅛ — 9	8⅛	8⅜	..	5 11
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1906)	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	5	..	..	4 3

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent.. February 10th, 1910.

THE LOADING OF TELEPHONE CABLE CIRCUITS.*

By A. W. MARTIN.

(*Continued from page* 153.)

The average inductance per mile of loop in the preceding case was changed by inserting the *same coils*, first at 1 and then at 2-mile intervals in the circuit, but in the trials next described the inductance per mile was varied by using *different coils* and keeping the spacing constant. The experiments were made upon a lead-covered cable 12 miles in length, containing 21 pairs of paper-insulated copper conductors, each wire weighing 100 lb. per mile and having a mean diameter of 79 mils. The electrical constants of the unloaded loop are :—

Conductor resistance per mile of loop	18 ohms.
Electrostatic capacity	0·055 mfd.
Inductance	0·001 henry.
Leakance	Negligible.

The attenuation constant as calculated from the ordinary formula for unloaded underground circuits is 0·042 per mile, which indicates that the unloaded 100-lb. conductor loops should be $0·103/0·042 = 2·45$ times better than standard cable from a telephone transmission point of view. By doubling to and fro in the 12-mile length of cable, different lengths of circuit were arranged, and their standard cable equivalents measured; the results are given in column 2 of Table III. It will be seen that any 24-mile length of the unloaded loop is equivalent to 10 miles of standard cable; therefore, the former must be 2·4 times better than the latter. The attenuation constant per mile as deduced from the experimental results is consequently $0·103/2·4 = 0·043$; a value nearly in agreement with that of 0·042 obtained by calculation.

TABLE III.

Mileage of loop under test.	Standard cable equivalent in miles.		
	Circuit unloaded.	Circuit loaded at 2·14-mile points.	
		Coil D.	Coil E.
24	10	8	8
48	20	12	12
72	30	16	16
96	—	20	20
120	—	—	24
144	—	—	28

Some of the pairs in the cable were next loaded with air-core coils of a type known as D, and others with coils of similar make known as type E. The electrical constants of these coils are : —

Type D.

Effective resistance	10·8 ohms, at 750 p.p.s.
Inductance...	0·070 henry " "

Type E.

Effective resistance	13·4 ohms, at 750 p.p.s.
Inductance...	0·083 henry " "

These coils were used, not because they were considered to be the best possible, but for the reason that they were in stock. The standard cable equivalents of various lengths of the loaded loops are shown in columns 3 and 4 of Table III. It will be observed that the results are identical. In each case—

First 24 miles of loaded loop	= 8 m.s.c.
Each " " " added	= 4 "
Difference = Terminal loss	= 4 m.s.c.

Either type of loaded circuit was consequently $24/4 = 6$ times better than standard cable, and the attenuation constant, therefore, is $0·103/6 = 0·0172$ per mile. By calculation from the formula for air-core coils the following values are obtained :—

Coils D. $\beta = 0·0162$ per mile.
Coils E. $\beta = 0·0158$ "

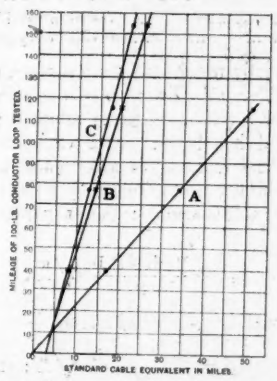
* A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

The circuits loaded with coils D and E, respectively, should be almost equally good, so far as calculation shows, since their attenuation constants only differ by about 2·5 per cent. The beneficial effect produced upon the telephonic transmission efficiency of the loops by the higher inductance of coils E, as compared with those D, is balanced by the adverse effect of the high resistance of the former as compared with that of the latter coils.

The calculated attenuation constant per mile of 100-lb. conductor loop, treated with either of the inductances above mentioned, does not differ materially from 0·0160, while the measured constant is 0·0172; thus there is a difference of about 8 per cent. between the calculated and observed values. This is not remarkable, considering that, although the average spacing was 2·44 miles, the actual distance between one coil and another varied from 2·05 to 2·89 miles; a difference of about 40 per cent. Whenever coils are very irregularly spaced in a loop some loss results from reflections between them. Wonder may be expressed at this irregularity in spacing, and in explanation it may be remarked that at the points selected for the insertion of the coils manholes, jointing pits and other facilities were in existence. It was not considered economical to construct new loading points by cutting the cable, and providing new pits for the accommodation of the coils, in order to obtain the slight increase in efficiency which would have resulted from uniform spacing.

The number of coils per wave at 2,000 p.p.s. will be found to be about 5 in the circuits loaded with coils D, and 4·7 in those loaded with coils E. The articulation of speech received over each type of loop was equally good.

At a time when little was known, experimentally, of the extent to which a loop might be improved by the use of loading coils, a long series of tests were arranged upon a cable 38·5 miles in length with an intermediate office 19·4 miles from the end at which the observations were made. Return loops of $2 \times 38·5 = 77$, or of $2 \times 19·4 = 38·8$ miles could therefore be arranged, and by joining several such loops in series considerable lengths of circuit were obtained. The cable consisted of 100-lb. per mile



A, Cable unloaded; B, cable loaded with air-core coils; C, cable loaded with iron-core coils.

Fig 16.—Cable Loaded at 1·1-mile Points.

conductor loops, the wires being paper-insulated and enclosed in a lead sheath. There were 28 pairs altogether. The electrical constants of the loops before loading were—

Conductor resistance per mile of loop...	18 ohms
Electrostatic capacity	0·055 mfd.
Inductance...	0·001 henry
Leakance	Negligible

(The capacity of part of the cable was 0·05, and of the remainder 0·06 mfd. per mile. The mean value of 0·055 was obtained by measurement on the whole 38·5 miles.)

Calculated from the usual formula for unloaded subterranean lines, the attenuation constant $\beta = 0·042$ per mile. The measured standard cable equivalents of different lengths of circuit are given in column 2 of Table IV, and shown by curve A in fig. 16. The untreated loops are 2·27 times better than standard cable; the attenuation constant per mile is therefore $0·103/2·27 = 0·045$ nearly, which result differs from that 0·042 obtained by calculation to the extent of 7 per cent. The cause of this discrepancy was not investigated, as, at the time the trials were conducted, it was

considered satisfactory if the observed and calculated results agreed within such a percentage.

A few years prior to the date of the experiments next to be described, the cable had been loaded with air-core coils. The importance of regular spacing was not then fully appreciated, and the loading points were very irregularly distributed along the route, the distances between coils varying as much as 60 per cent. The mean spacing distance works out at 1·1 mile. These old coils had to be removed because the wooden cases, originally employed, failed to keep out moisture, and the insulation resistance of the enclosed coils became very low. Whether the more modern double wooden boxes, already described, will prove more effective has yet to be determined; but it is very doubtful whether any wooden case will last long in an underground pit liable to flooding, and which in any circumstances alternates in condition between "wet" and "dry." The reasons why air-core coils cannot be encased in any metal have been stated already. After the old coils had been removed from the circuits, and the cable wires raised in insulation resistance by desiccation, the previously given trials were made on the unloaded loops.

In the more recent loading of this cable some of the loops were fitted with air-core, and the remainder with iron-core coils; the primary object being to determine which type of coil was the better as regards the *clearness* of speech transmitted—*i.e.*, which was the better from the "articulation" point of view. A secondary object—but not less important—was to ascertain what the most economical loading would be, having regard to both the clearness and the loudness of speech received. Incidentally, other interesting points were investigated, such as the measurements of mixed circuits, terminal loss, &c., all of which will be dealt with in due course.

Confining attention to the main points, it may be explained that the two types of coil used in the comparison tests were—

(*a*) Air-core Coils. Type F.

Effective resistance	15·4 ohms at 750 p.p.s.
Inductance	0·100 henry at 750 p.p.s.

(*b*) Iron-Core Coils, W.E. Co.'s Type 507.

Effective resistance ...	5·4 ohms at 750 p.p.s.
Inductance	0 133 henry at 750 p.p.s.

It would occupy much too long a time, and too great a space, to consider all the results obtained in the same detailed manner as that hitherto adopted; it is therefore proposed to deal briefly with each experiment, and to give a summary of the deductions after each table of results. Only bear in mind throughout (1) that for air-core coil loaded loops the attenuation constant per mile is calculated from—

$$\beta = \frac{R + 50\,L}{2}\sqrt{\frac{K}{L}},$$

and for those with iron-core coils from—

$$\beta = \frac{R + 80\,L}{2}\sqrt{\frac{K}{L}};$$ and—

(2) that the decimal points shown in connection with the measurement of standard cable equivalents were not due to estimation during the trials, but were the result of the previous calibration of the particular standard cables employed in the tests. The steps by which the standard cable length could be increased, varied somewhat as follows:—1·1, 2·1, 3·2, 4·3, &c.

Experiment (*a*). Coils were inserted in the loops at 1·1 mile (average) intervals; some of the circuits being loaded entirely with the air-core, and others with the iron-core type. The measured standard cable equivalents of various lengths of each kind of loaded loop are given in Table IV.

The results are shown by the curves in fig. 16. Reading from the curves, the terminal loss and observed attenuation are found to be as shown below:—

Air-Core Coil Loaded Loops.

Terminal loss = 3 m.s.c.

Excluding terminal loss, the loops are 6·9 times better than standard cable. Observed attenuation constant is, therefore, 0·103/6·9 = 0·0149 nearly per mile.

Calculated β = 0·0141 per mile.

Coils per wave-length at 2,000 p.p.s. = 6·4.

Iron-Core Coil Loaded Loops.

Terminal loss = 3 m.s.c.

Excluding terminal loss, the loops are 8 times as good as standard cable. Observed attenuation constant is, therefore, 0·103/8 = 0·0130 nearly per mile.

Calculated β = 0·0110 per mile.

Coils per wave-length at 2,000 p.p.s. = 5·6.

The quality of speech transmitted over the two types of circuit was very good. A direct comparison was made by placing an air-core coil loaded loop in the position occupied by the standard cable shown in fig. 13, and an equivalent iron-core coil loaded circuit where the "loop under test" is shown in the same figure. An instantaneous change-over from one circuit to the other, by means of the switch, showed that no difference existed between the types of loop so far as the clearness of transmitted speech was concerned. This observation indicates that the presence of iron cores in loading coils does not adversely affect the articulation of the speech received.

TABLE IV.

Mileage of loop under test.	Standard cable equivalent in miles.		
	Circuit unloaded.	Circuit loaded at 1·1-mile points.	
		Air-core coil F.	Air-core coil 507.
38·8	17	8·5	8·0
77·0	34	14·2	12·6
115·8	51	20·0	17·9
154·0	—	25·3	22·2

(*To be continued.*)

REVIEWS.

Chats on Electricity—Told in Plain Language for the Non-Technical. By Frank Broadbent, M.I.E.E. London: T. Werner Laurie. Price 3s. 6d.

We have been a long time making up our mind as to what we shall say of Mr. Broadbent's latest book. We like its title, and likewise its object, but somehow or another we are not quite able to give it our entire approval. The author states in his preface that he has attempted to explain in language which may be understood by any person of average intelligence and education the nature and properties of electricity, and to explain the uses of some of the apparatus in general use. At the same time, he points out that it cannot be described as a popular book in the ordinary acceptance of the word; "that is to say, it is not written in the colloquial or off-hand style which appears to be the hall-mark of the popular book." It is here that, in the first place, we feel the author has not quite risen to his task. Having addressed himself to "any person of average intelligence and education," it is hardly the correct thing to indulge in unnecessary repetition of words. This is a feature which dominates the whole work, and reaches its maximum on page 114, where the word "magnet" appears three times in one line and four times in two; and on pages 175 and 176, where a whole sentence is repeated. We cannot help feeling, too, that the text could have been a little better collated, and thus, for instance, have rendered unnecessary the numerous references and repetitions with regard to electric bells, and also the very unusual feature of having the same illustration or diagram twice in one book, fig. 13 being identical with fig. 1.

There are certain blemishes which might have been noticed by the printers' reader; but, apart from these criticisms, the book, in its seven chapters, contains a large amount of information which should prove instructive to a very large class. After discussing the characteristic properties of the electric current—chemical, magnetic and heating—Mr. Broadbent goes on to treat of the practical application, and then goes very fully into the questions of measurement and distribution. His

explanation as to the method of working of electrical measuring instruments should appeal, for example, to motorists and motor-cyclists, who, in connection with the ignition in the engines of their machines, have long made use of ammeters and voltmeters—more particularly the latter—and who, while knowing their use, have, in the majority of cases, but a faint idea as to how they work. The sections devoted to the Telephone, the Telegraph and Electric Tramways will be found of great interest, for they explain in simple language the why and wherefore of three great items of modern life that are daily made use of by the public with little or no knowledge of "how it is done." There are thousands who pay 2d. at a call office to use the telephone, hand in a 6d. telegram at a post office, or pay their fare on an electric tramcar without a thought of the many scientific problems that have had to be solved ere such conveniences could be placed at their disposal, and who cannot fail to have their interest aroused by a perusal of the volume before us.

While we regret to have been unable to give Mr. Broadbent's book as high a praise as we should desire in view of the usefulness and interest of the author's contributions to the *technical* Press, it is one that, appealing as it does to a large section of the public, should reach several editions, and therefore we think that the author will be well advised to go carefully over his work on the lines we have suggested, and by cutting out much of the unnecessary repetition, find space for other matter of a useful and instructive nature.

The Engineer's Year-Book of Engineering Formulæ, Rules, Tables, Data and Memoranda for 1910. By H. R. Kempe, M.Inst.C.E., M.I.E.E. London: Crosby Lockwood and Sons. Price 8s.

The new edition of this well-known work has just been issued, and it will doubtless find its way to a convenient place near the elbow of many a busy engineer. It is now quite an old friend, the present being the seventeenth issue. The care with which the work of revision has been carried out from year to year is evidenced by the growth of the book to more than twice its original size. Mr. Kempe has availed himself of the help of experts in many subjects included in the present volume, thus ensuring the reliability of the information given. The sections which appeal specially to engineers have, on the whole, been brought thoroughly up to date; thus, the one dealing with steam leaves little to be desired, though room might be found in future issues for notes on the latest practice in the manufacture of both Lancashire and water-tube boilers. A new section has been contributed by Mr. G. H. Lanchester on motor-cars, which clearly indicates the present position of this important industry. Other sections which have been rewritten for this edition are those relating to hydraulics and hydro-electric plant, harbour and dock engineering, gas and gas works, and reinforced concrete.

As regards the electrical engineering sections, several recent developments are noted, such as the C.M.B. converter and the metallic-filament lamp, while the recommendations made by the Engineering Standards Committee in 1907 for dynamos, alternators, motors and meters are given.

We think, however, that the advances which have been made in electrical engineering practice during the past two or three years would warrant the rewriting and entire rearrangement of this section for the next issue. The attempts which have been made by addition and excision to bring it thoroughly up-to-date have not been altogether successful, and though much useful matter is included in the issue, it suffers from want of arrangement and a due sense of proportion. Thus the references to metal-filament lamps are meagre, the latest practice in electric illumination is very partially noticed, and this under headings in different parts of the book, the 1903 issue of the rules of the Institution of Electrical Engineers still holds sway, though they were revised in 1907, and while some systems of electric house wiring receive lengthy notice, others are not referred to.

These remarks are not made in any captious spirit, for we have ourselves proved the value of the book by constant use for many years.

In a similar way the references to electric tramways might be revised, and with a sub-section devoted to electric railway working this section could be greatly increased in value.

The references to electric power tariffs on page 962 are unconvincing, as the particulars of the conditions under which the supply is given are not stated, and it is not clear whether the rates apply to tramway supply or ordinary industrial motor work. Some details as to the average rates for works supply under different works load factors charged by the various power companies would be of interest and value.

The comparative estimates of cost of electric power given in the producer-gas section take too high a price for electrical energy at such a high load factor, and quite omit to explain that the figures as given are only applicable to constant full-load conditions which rarely prevail in industrial works, and that in ordinary practice electric power has a number of other advantages.

We would suggest that in the next edition the subject of illumination should be treated as a whole, the relative advantages of different illuminants being given, and the usual practice detailed as to intensity of illumination for different classes of rooms and buildings, together with some examples of costs of different forms of lighting. This information would be of real service in view of the increased attention now being paid to this subject.

Space prevents our doing full justice to other sections; the one on steam turbines is especially good, while the data given on general subjects are invaluable to the practical man.

Electricity and Magnetism. By G. Carey Foster and A. W. Porter. Third Edition. London: Longmans & Co. 1909. Price 10s. 6d. net.

In our student days, most of us have owed much, either directly or indirectly, to the French text-books on physics. Joubert, Ganot, Mascart, Deschanel, are all names which sound familiar to English readers. In the best French text-books there is a characteristic directness and crispness of treatment which make a subject appear at once simple and clear, without any laborious preparatory explanation. Whatever mathematical expressions are employed, are introduced just where they are necessary, as being the most concise statement of the relations to be arrived at. The calculus is not avoided, where it is helpful, but, on the other hand, one never has the feeling that mathematics is introduced for the sake of the mathematics. It is always made to fulfil its proper function of acting as means to an end.

The simplicity of style and directness of treatment of which we have been speaking were characteristic of Joubert's Traité Elémentaire d'Electricité, on which the authors of the book before us modestly say that their treatise has been "founded." A text-book on electricity and magnetism based on such a model, and adapted by capable writers to conform to the modern views derived from Faraday, Maxwell, and their successors, could hardly fail to be a most valuable work for the present-day student. It has already won a firmly established position amongst the best modern physical text-books. In the present edition a number of additions have been made to various sections, and the last chapter, on "Recent Developments," has been rewritten in order to bring it up to date. This chapter forms a summary of the most important points established by recent research on the cathode stream, Röntgen and Becquerel rays and radium emanations. It also gives an outline of the electron theory of conduction, and of thermo-electric and magnetic effects. The student is thus brought into touch with the most recent line of development of electrical theory.

The writers have wisely made no attempt to extend the chapters dealing with electrical machines, but we think that they might have added a little more detail to the sections on wave telegraphy, and that they might have made some reference to wireless telephony, without overstepping the bounds of a theoretical treatise.

In conclusion, we would commend this book specially to students of electrical engineering, as forming an admirable basis of electrical theory on which to found their later study of technical electrical text-books dealing with machinery, transmission, polyphase currents, and the numerous specialised branches with which they may have to deal. Even the

trained electrical engineer dealing with highly technical and complicated practical questions is constantly brought face to face with purely theoretical problems, which he can only solve by going back to first principles. His success in coping with such subjects as the phenomena of pressure rises in polyphase cables, high-tension insulation, magnetic leakage, the design of large batteries, magnetic relays and a hundred others will depend largely on his grasp of the fundamental principles of the theory of electricity and magnetism.

The serious study of such a book as the one under consideration, during his student days, should form part of the training of every electrical engineer who aspires to take his place in the ranks of progress, or even to follow intelligently where others lead.

A Handbook of Wireless Telegraphy. By J. Erskine-Murray, D.Sc. London: Crosby Lockwood & Sons. Second edition. Price 10s. 6d.

This book forms a fairly complete and comprehensive treatise on wireless telegraphy, some minor alterations and additions having been made since the publication of the first edition. The reader is, however, still liable to have his confidence in the author rudely shaken by inaccurate or unscientific explanations given in one or two instances, referred to in reviewing the first edition. In the case of the Schaefer anti-coherer, the reader is still asked to believe that the applied E.M.F. of 3 volts (which should be not more than 1·5 volts) is sufficient to set small particles of silver dancing across the slit by electrostatic attraction and repulsion, and that these antics can be observed under the microscope. Also, that such an effect is sufficient to account for the conductance normally exhibited (which may allow of several milliamperes of current being passed across). It is evident that Dr. Erskine-Murray has not yet brought the microscope into use to bear on the question, though, indeed, this should hardly be necessary.

Dr. Erskine-Murray would also be well advised to correct his statement still occurring (page 240), that rarefied gas is necessarily conductive. The normal condition of a rarefied gas at any pressure is non-conducting.

A frontispiece has been added in the shape of an outline map which shows the location and ranges of the various coast stations in Great Britain.

La Télégraphie sans Fil. By Albert Turpain. Second edition. Paris: Gauthier-Villars. Price 19 fr.

This work covers the theory, development and applications of Hertzian waves, and presents the subject from the point of view of modern French practice in a clear and concise manner. In addition to wireless telegraphy, various chapters in this edition are devoted to such applications of Hertzian waves as wireless telephony, control of mechanical movements at a distance, forecasting storms by the advance electrical disturbances they produce, various effects produced by high-frequency currents, and proposed methods of applying high-frequency oscillations to ordinary telegraphy with conducting wires. The book will, however, mainly interest English readers in its descriptions of special apparatus for wireless telegraph installations. A full description, with statement of results obtainable from M. Klingelfuss's closed-circuit high-tension transformer designed to replace the relatively inefficient Rhumkorff coil, will, for instance, no doubt be read with interest. The author is, it is thought, inclined to view too hopefully the future of applications of electric waves such as those concerning duplex and even multiplex telegraphy with wires.

Macclesfield.—Mr. R. Fox, of the Railways and General Development Co., Ltd., has informed the T.C. that he is prepared, in conjunction with Mr. Blackmore, engineer to the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, to promote a company and arrange for the whole of the capital to be provided, for the putting down of an electric lighting and power plant, and for the working of electric railless trolley cars in the borough

THE COMPARATIVE COST OF ELECTRICITY AND "AIR-GAS" FOR ILLUMINATING PURPOSES.

[CONTRIBUTED.]

A good deal has been heard lately of the very great advantages, especially from the point of view of economy, which may be obtained by the installation of one of the various types of air-gas generators for country-house lighting and similar purposes.

These machines make a gas which usually consists of 98½ per cent. of air and 1½ per cent. petrol vapour, and there is no doubt that the system is a very simple, safe and economical one and much in advance of any other form of gas supply for isolated installations. When, however, the makers of these machines put forward all sorts of extravagant statements as to the superiority of their gas to electricity, it is as well to examine their figures and see how they are arrived at.

In a pamphlet which we have before us, one of the advantages claimed for that particular type of air-gas machine is that the gas which it makes "is the only illuminant which combines absolute safety with perfect simplicity, while its cost is but a fraction of that of any other known system."

Figures are then given to prove (?) the wonderful economy of air-gas compared with other illuminants; thus: "Careful tests have shown the comparative cost of various systems for maintaining 100 c.p. for 10 hours, or its equivalent, to be as follows:—

	s.	d.
Acetylene	1	3
Electric incandescent	1	2
Flat flame coal gas	1	0
Duplex oil lamps		7¼
Incandescent coal gas		2½
Air-gas		1⅞

"In this table coal gas has been assumed to cost 3s. per 1,000 cb. ft. and electricity 3½d. per unit, which are fair averages."

The above table is grossly unfair to electricity. To begin with, the cost of 1⅞d. for air-gas is for petrol only, whereas the 1s. 2d. put down for electricity either includes the price charged by a public supply authority, or else, if it be a private plant, the price includes all capital charges.

Moreover, be it noted that carbon and not metal-filament lamps are obviously the type used for purposes of comparison.

It will be of interest to see what the true cost of electricity really is, when calculated on the same basis as air-gas at 1⅞d. per 100 c.p. for 10 hours.

The "air-gas" machines are listed in sizes to supply from 35 lights up to 150 lights. Each light is assumed to give 50 c.p. From the lights which we have seen in the makers' showrooms, we should be inclined to divide this figure by 2.

Let us assume a 100-light machine, which can, according to the makers, supply 5,000 c.p. To obtain this illumination by electricity, we should, when using 50-c.p. metal-filament lamps taking 1·2 watts per candle, require a 6-kw. dynamo. The dynamo would be direct coupled to a paraffin engine, of which there are several makes now on the market, the consumption of paraffin being guaranteed not to exceed ·8 pint per B.H.P.-hour.

Taking the efficiency of the dynamo at 80 per cent., and the price of paraffin 6d. per gallon, then the cost of 100 c.p. for 10 hours works out at 1·2d., instead of 1s. 2d., as stated by the gas people, or in other words, the cost of 1,000 c.p.-hours using electricity is 1·2d., as against 1·75d. with air-gas, or a saving of ·55d. per 1,000 c.p.-hours.

From the point of view of capital cost, it is necessary to take into consideration the value of the light unit which is available in each instance. In the case of electricity, it is usual to adopt lamps of 16 c.p. as an average for isolated installations, whereas with incandescent gas, the burners are usually rated at from 30 to 60 c.p. This involves, in the case of gas, installing more candle-power than is actually required, as in most instances 16 c.p. is all the light that is

required to be concentrated at one point. Taking as an example a 100-light installation, the capital cost of a paraffin-driven electrical generating plant would be £95, whereas the cost of an air-gas plant for an equal number of lights would be £90, or practically 5 per cent. in favour of the air-gas plant; cost of erection being included in neither case.

As the air-gas machine does not provide for storage, we have, for purposes of exact comparison, taken an electrical plant on precisely the same lines, and have not allowed for storage. In all country-house installations, however, it is standard practice to provide a storage battery, and we will, therefore, modify our estimate of capital expenditure accordingly. Taking the 100-light installation, we will now assume that a generating set is put in which can supply 60 per cent. of the lamps at one time; the cost of this, together with the necessary switchboard and connections, would be £82, and the cost of a battery capable of supplying 50 per cent. of the lamps for a period of 6 hours would be £19, or a total of £101 for the complete plant. It is perfectly fair to take a generating set and battery of the above sizes, because in practice it is found that in an installation such as we are discussing, the average maximum load seldom exceeds 50 per cent., and the average normal load 45 per cent.

The final conclusions at which we arrive, therefore, are that—

1. In the matter of running cost, electricity generated by a paraffin or petrol set is actually much cheaper than "air-gas."

2. That if no storage is provided, then the capital cost of the electrical plant is slightly in excess of that of the air-gas plant.

3. If a storage battery be provided with the electrical plant, then the cost of the plant, plus the battery, is 11 per cent. more than the cost of its rival, but, of course, the electrical proposition possesses important advantages as compared with gas in virtue of the convenience of storage.

Whilst admitting the advantages of air-gas over other forms of gas for illuminating purposes, we feel very confident that a prospective purchaser would not hesitate to incur a capital expenditure increased by 11 per cent., or even considerably more, if by so doing he was enabled to purchase an electric light plant with storage, as against an air-gas plant without. And this is quite apart from the great advantages which electricity possesses in the shape of providing energy for the operation of fans, heaters and small motors.

In getting out the above figures, we have endeavoured to avoid following the example of our gas friends in overstating the case, but have given as far as possible figures which can be relied upon, and which will bear investigation.

TECHNICAL TRAINING.

By E. KILBURN SCOTT, M.I.E.E., A.M.I.C.E.

In a paper read at a meeting of the New York State Street Railway Convention last year, Prof. H. H. Norris summarised replies which he had received from managers of street railways regarding the relation of the technical school to the business and profession of electric railway work. The queries were unusually frank and to the point:—

"How do you regard an application from a young technical graduate for a position"? The answers were in all cases "favourably," and this is a clear indication that men with a technical training have been found to be so satisfactory in the past, that the railway companies can do with more of them.

The next questions were, "Do you find these young men, as a rule, humble or conceited"? and "Are they improving in this respect"?

There is no doubt that much of the feeling against what is called theory is due to some college-trained men having "put on side" in the workshops. This attitude naturally arouses resentment in fellow employés, and the young man suffers until such time as he has learnt to have a proper appreciation of his own insignificance. Such men are a nuisance whilst their conceit lasts.

Another question was: "Which of two men would you prefer to employ for general work: one with no technical training and 10 years' experience of a general nature, or a recent technical graduate"? This question is difficult to answer, but there is no doubt that if the position is one which requires ability to do a particular thing well and at once, the experienced man naturally brings the quickest returns to his employer. As a matter of fact, the question is at fault, because it takes no account of the fact that, thanks to numerous polytechnics, evening technical schools, and correspondence courses, nearly every young man is now able to get a certain amount of theoretical training. It is such men who form the backbone of the non-commissioned officer class of engineering. Unfortunately, at the present time there is a tendency to starve technical institutions, polytechnics, mechanics' institutes, &c., where evening-class instruction is mainly carried on. This is partly due to the fact that representatives on the bodies controlling educational expenditure are mostly those who get their living entirely by teaching, or where they are not members of the teaching profession, they are men whose training and social position prevent them being in touch with those who can only attend evening classes. The evening-class or part-time man has little or no representation.

There has been much criticism of evening-class instruction, but facts prove that by following out a prescribed course of evening-class instruction for several years, many part-time students can hold their own with the full-time college-trained men. The fact that their theoretical studies are sandwiched in day by day with practical work in the shops, drawing office, or estimating department, makes it all the easier for them to assimilate information and get a broad view of their work.

One fault of evening-class instruction is that it is somewhat disconnected, but this may be rectified by improved organisation and a close connection between the various polytechnics and other institutions throughout the country, so that in case a young man moves from one town to another, he may continue his studies in proper sequence.

Employers are coming to recognise the value of a scientific training, and it will become more evident, as the younger men who have been so trained get into positions of responsibility. A sign of the times is the decision of 15 of the Leeds engineering firms to excuse their apprentices from working overtime, so that they may attend evening classes.

The scheme started by Messrs. Belliss & Morcom is worthy of all praise. All the apprentices of this well-known firm have to attend approved classes at the Birmingham Technical School or the University. The firm watches the progress of the apprentices at the technical school as closely as in its own works, and promotion in responsibility and pay is dependent on the theoretical as well as the workshop training. The indentures specify that the apprentices must attend a certain number of evening classes per week, and those who show special aptitude in the works and technical classes are allowed off two afternoons per week to attend further lectures and laboratory instruction.

In the series of questions above mentioned there was a unanimous reply to the query "How would you advise a young man fresh from college to try and enter the electric railway field"? It was "Start at the bottom and work up," or, as one superintendent put it, "begin at the rear end of the car."

THE KEARNEY ELECTRIC RAILWAY.

In June, 1908, a demonstration was given of the Kearney system of "high-speed railway," and in our issue of the 19th of that month we expressed our opinion as to the value of the claims put forward by the inventor. We showed that, so far as the use of two rails in a vertical plane was concerned, this had been anticipated by Mr. Danchell, who in 1883 had constructed an experimental track at Maidstone 60 ft. in diameter, on which a car propelled by electric

motors had been run. The similarity of the two systems was shown by parallel columns: one giving portions of the description of the Danchell system which appeared in our issue of December 22nd, 1883; and the other, extracts from the Kearney Co.'s pamphlet and prospectus.

Since that date the system has been further developed in a direction which is, perhaps, best explained by the following paragraph, taken from a pamphlet written by the inventor, Mr. E. W. C. Kearney, and issued by the Kearney High-Speed Railway Co., Ltd.:—

However, at the time the writer first put forward his proposals for liftless, steep-gradient tube railways he had not thought of the possibility of still further reducing the cost of construction by the elimination of one of the two tubes hitherto necessary for safe working.

The system as now put forward and proposed for use in two railways, for which it is stated Parliamentary powers will be sought in the Session of 1911, comprises:—

1. A single tube between stations, with passing places at each station.

2. A combination of a shallow and deep level railway, the stations being immediately below street level and the main part of the line 90 to 100 ft. below, gradients of about 1 in 7 connecting the station with the deep level portion of the line.

3. The use of two rails placed vertically instead of horizontally in respect of each other, thus permitting the employment of high speeds and the avoidance of lateral oscillations.

4. The saving of power due to taking advantage of the rapid acceleration and retardation caused by gravity acting on the gradients of 1 in 7 from and to the stations.

5. The use of very high maximum and average speeds.

6. Lower cost of working due to the above causes and also to the lower capital charges necessitated by the reduced cost of construction.

A model on a scale of $\frac{3}{4}$ in. to 1 ft. has been made, and runs on a track 60 yards long in one of the galleries at the Crystal Palace. A party of Press representatives were entertained at luncheon at the Crystal Palace on the 2nd inst., when the first public demonstrations with the model were given. Several speeches were made drawing attention to the many advantages claimed for this method of working, and referring to the proposed lines—namely, one from Cricklewood to Kennington, and the other from the Strand to the Crystal Palace. The length of each line would be 7 miles, and the schedule time would be 14 minutes from Cricklewood to Kennington, and 12 minutes from the Strand to the Crystal Palace, the average speed (including stops) being from 30 to 35 miles per hour, or more than twice that of the existing tubes.

The idea of using a single tube for a frequent service of trains running at high speeds through tunnels in opposite directions is so opposed to present-day railway practice, and the inevitable consequences of two trains accidentally getting on the same section are so terrible to contemplate, that we do not think there is any likelihood of Parliamentary sanction being given to the application.

The details of the point shifting devices are ingenious, and the results obtained in the model by the use of ball bearings very satisfactory; but we are entirely unconvinced as to the practicability of the system as a whole. With the exception of the single tube between stations, the leading features of the system are old acquaintances, if not old friends, and the statements as to cost of construction, as well as to costs and conditions of working, will not, in our opinion, be borne out in practice. Near the stations the disturbances with existing pipes and obstructions may be very serious, and this alone may very materially affect the construction costs.

The company state that their proposals meet the recommendations of the Royal Commission on London Traffic respecting the possible combination of a shallow and deep level line from North to South London, but one fails to find in the Commission's report any approval of the single tube between stations, which is apparently an integral feature of the present plan.

It is claimed that the total cost of construction of a tube line on this system would not exceed £250,000 per mile, as against £400,000 to £800,000 per mile for existing lines, and that with double the average speed the working costs would only be two-thirds of those of the present tubes. It is further suggested that tubes constructed on this system will be much more popular on account of the absence of lifts, while the time thus saved will enable them to get a large short-distance traffic. Under these conditions all that remains is apparently to decide on the dividends required by the shareholders, and then reduce present rates of fares to suit. Truly an attractive prospect, but one which needs far more data than have at present been made public by the company to convince practical men of its feasibility.

THE RUSSIAN ELECTRICAL INDUSTRY.

A St. Petersburg correspondent of the *Anglo-Russian Gazette* has made inquiry as to the course of business experienced by Russian electrical firms during 1909. "He learns that in general this particular branch did not correspond with the expectations which were entertained at the beginning of the year. Orders for the account of the Government, as in 1908, also failed to make their appearance last year, and the work for towns was also slight. The demand for electrical installations in the weaving industry did not increase, owing to the crisis prevailing in this branch; the electrical companies did not compete for new concessions, and large orders were also lacking for the iron and steel industries. Notwithstanding the scarcely favourable situation, the Russian A.E.G. experienced a larger turnover than in the preceding year, and the dividend is estimated at from 7 per cent. to 8 per cent., as compared with 6 per cent. in 1908. As far as concerns the question of the formation of a syndicate in the electrical installation trade, it is considered that the problem is incapable of solution under existing circumstances, and that the situation of some competing companies is so unsound that their liquidation is foreseen. If, however, a syndicate should be constituted, it would principally be composed of the three German companies, in the shape of the Russian Schuckert Co., the Russian Siemens & Halske Co., and the Russian A.E.G."

In a later issue of the *Anglo-Russian Gazette* there appears a note entitled "England as Rival," in which it is stated that the Continent in general, and one country in particular, is feeling very sore in consequence of the remarkable expansion of our trade with Russia. Manufacturers say that for the last 20 years they have spent a lot of money in developing trade with Russia, and that now England is reaping the benefit without having worked for it. It is suggested that the investment of English capital in Russia is reducing the influence of Continental capital considerably. The fact of the matter is, says our contemporary, that England's commercial relations with Russia date back for over a century, and that the manufacturers who were instrumental in developing the modern factory system in Russia came to England as young men to study English ways and methods. Not only did they learn our language and our business methods, but they were impressed with English thoroughness and straightforwardness, and had it not been for unfortunate misunderstandings which were allowed to crop up over the Eastern Question, the cordial relations between the two countries should have suffered no partial eclipse.

Copper.—Under date February 26th the *Financial News* publishes an article on the progress of the combination of producing companies which the leading interests in the States are endeavouring to bring about. From this we learn that, at the meetings of the Utah and Anaconda, to be held this month, proposals will be brought forward for carrying the amalgamation of the two groups into effect. At the first meeting, the New York correspondent of the *News* states, a large majority of the stock of Nevada Consolidated will be voted in favour of an exchange for Utah copper stock. The Utah company is, if the proposals are accepted, to increase its capital from $6,597,500 to $25,000,000. The surplus stock is to be allotted to the purchase of Boston Consolidated, Ohio Copper, Garfield Smelter Co., and Baltimore Smelter securities, with a certain proportion (736,000 $10 shares) for the existing shareholders of Utah. Meanwhile, the Anaconda is to increase from $30,000,000 to $150,000,000, and exchange the stock for that of Boston and Montana Consolidated, North Butte, and Butte and Boston Consolidated. The present capitalisation of these concerns is about 13 millions sterling; the capitalisation under the control will be about 35 millions; but this does not take into account the Amalgamated stock. Whether this is precisely the propitious moment for effecting the "corner" is difficult to say; once formed, with railway electrifications in prospect, it would be a rich corporation. It is, however, evident that it is not an easy operation to bring the various interests together. Surely this kind of things belongs to a low-priced period. Meanwhile (Messrs. Merton's return for February 28th) the visible supplies continue to pull up slowly, being now 113,455 tons; and supplies all round, even from the States, are up to average for the current year, though below that for the year preceding.

PROCEEDINGS OF INSTITUTIONS.

Some Notes on Overhead Line Construction.

By W. B. Woodhouse, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Leeds, February 23rd*, 1910.)

(*Concluded from page* 370.)

Poles used to support wires are subject to three loadings under normal conditions: the weight of the wires, the wind pressure on the wires as sustained at the points of support, the wind pressure on the pole-surface and its top hamper (brackets, arms, insulators, &c.). At angles the component of the wire tensions must be aided and either met by a stiffer pole or by staying. The important stresses are due to wind pressure on poles and wires.

For spans up to 100 yards wooden poles are cheaper than iron, for longer spans lattice-work iron towers may show an advantage in cost.

Wooden poles are usually of red fir, winter felled, and creosoted. The poles should be well seasoned before creosoting, and if properly treated will have a life of 15 to 20 years under average conditions.

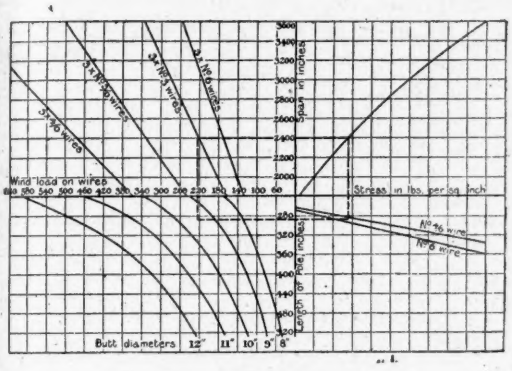


Fig. 2.

The taper of the poles is a matter beyond our control, but it is advisable to use only poles having a maximum strength of rupture at the ground section, as in course of time this part of the pole will decay most rapidly. Assuming the load concentrated at the pole-top, the proportion of taper to secure this is that the diameter at the top should be not less than two-thirds of the diameter at the ground. The depth to which it is necessary to set the poles in the ground depends on the nature of the soil—usual practice is to allow from 5 to 8 ft.

The breaking load of a fir-pole is expressed by $W = 766\ D^3/H$, a formula derived from the Post Office tests. As under the Board of Trade rules a factor of safety of 10 must be allowed, the safe load is one-tenth of the value found from the above.

As an example of the magnitude of this allowance the maximum safe load on an 8-in. pole at 30 ft. with A = 3 ft. is reduced below the gross by 18 per cent. In specifying a series of poles of varying heights for general purposes, the net strength is the figure of importance. From the formula above given a series of poles of equal net strength may be calculated.

We may now proceed to draw the working curves, fig. 2. It is convenient to plot in the quadrants between rectangular axes:—

1. Span and stress in wires.
2. Span and wind load on wires.
3. Net pole strength and height to loading point for poles of various diameters.
4. Stress in wires and summer sag.

From these curves the effect of varying the span on the size of poles can be readily seen and the merits of each particular case considered.

For example, if three No. 3 wires are to be used the span is assumed at any likely figure—say, 200 ft.; it may be fixed by physical conditions. Reference to the second quadrant and the line corresponding to three wires of No. 3 gives the wind load on wires, which is equal to the net pole strength required. The minimum head room being 20 ft, reference from the first to the fourth quadrant gives the maximum summer sag, and therefore the length of pole required (20 + summer sag) = height to point of loading (24 ft.). Following the abscissa from this point into the third quadrant to its intersection with the ordinate representing the net strength required gives, if the point falls on a "diameter" curve, the size required (namely, diameter = 9·5 in.); if it falls between curves the next larger diameter must be chosen.

It may be noted that the heights corresponding to the intersection of an ordinate in the third quadrant with the "diameter" curves will give the scantlings of a series of poles of varying height and equal net strength.

The previous consideration has dealt only with normal stresses. Of abnormal stresses, the breaking of all wires in one span, and the consequent loading of the support by the unbalanced tension in the remaining spans, is the most important. It is obvious that a support which is elastic in the direction of the wires will in such a case reduce the tension.

The advantages of flexible poles in line construction have been pointed out by Mr. A. P. Trotter. In addition to the flexibility of the poles, there are many modifying circumstances tending to prevent the wrecking of a number of spans due to such a cause as the above. Wire clips to the insulators will break and allow the wire to slip, insulator pins and arms will bend and foundations will give. Small deviations on the points of support from the straight line are a natural advantage which it is difficult to avoid. Vertical deviation of the supporting points may be taken advantage of to equalise stress under varying conditions if flexible suspensions are used.

The effect of an elastic pole in modifying stress due to broken wires may be studied by means of a diagram connecting (L — *l*) and F. The unbalanced load on the pole will cause a deflection within the limits of elasticity until the tension of the wires equals the elastic force. For wooden poles the deflection as ascertained by Post Office tests is—

$$\text{Deflection} = \frac{1}{216{,}000} \times \frac{W H^3}{D^4}.$$

For a single span the determination is simple (fig. 3).

Let the ordinate to A represent the stress in one wire and assume all *n* wires break. The pole deflection with stress is known. Set off from B a line B C so that A C = pole deflection corresponding to

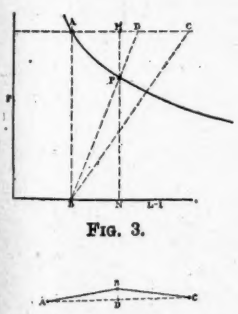


Fig. 3.

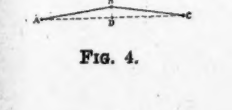


Fig. 4.

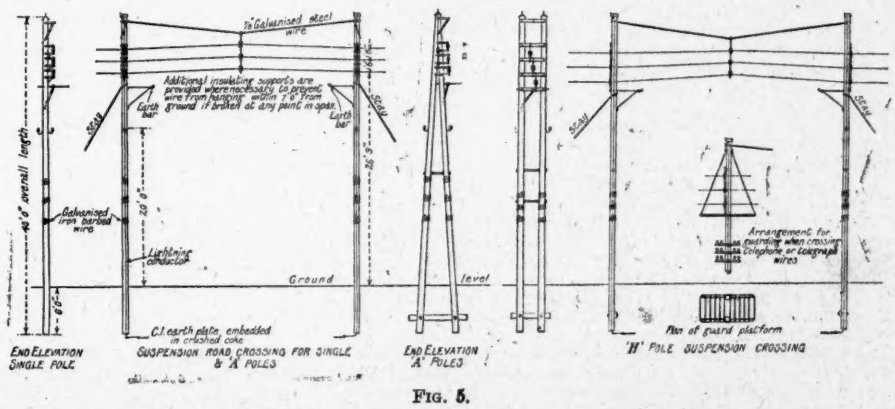

No. 6 Galvanised steel wire
Additional insulating supports are provided where necessary, to prevent wire from touching within 7' 6" from ground if broken at any point in span.
Earth bar
Galvanised iron barbed wire
Lightning conductor
Ground level
C.I. earth plate, embedded in crushed coke
End Elevation Single Pole
Suspension Road Crossing for Single & 'A' Poles
End Elevation 'A' Poles
Arrangement for guarding when crossing Telephone or Telegraph wires
Plan of guard platform
'H' Pole Suspension Crossing

Fig. 5.

To the designer the important figure is the net strength available for resisting the wind load on the wires, which is found by deducting from the safe load, the load due to wind pressure on the pole-surface, insulators, brackets, &c.

If H be the distance from the ground to the point of loading, the surface of the pole above this plus the insulator and bracket surfaces may be reduced to an equivalent length of pole-surface.

The gross safe load applied at a distance H from the ground, neglecting wind pressure on pole, is $W = 76{\cdot}6\ D^3/H$.

The net safe load, equivalent to wind load on wires, is—

$$\tfrac{1}{10} D/H \,.\, (766\ D^2 - \tfrac{1}{10} H\,(H + A)),$$

where A is the equivalent extra length of pole surface.

(*n* × F). Set off from C, C D equal to the elongation of wire at stress F. Join B D, then P gives the ultimate deflection of pole and stress per wire corresponding to equilibrium. This assumes the second pole from the break to be rigid, if it be not so it will deflect away from the break due to the initial difference of stress represented by *n* (A B — P N). The case has been analysed by Mr. Trotter, who states that the effect will not be appreciable past the fifth pole.

The effect of a deviation of the supports from a straight line in equalising the stress on the wire at all temperatures is of interest.

Let A B C be three supports, the deviation of B from the straight line being B D. There is due to the tension of the wires a tendency for A and C to bend approximately at right angles to A C, and for B to bend in the opposite sense. Assuming the wires to contract

due to a fall of temperature, this bending movement becomes greater, and the poles will deflect so as to decrease the stress on the wires.

Let AD = l. DB = x, AB − AD = e, < BAD = θ. Then, approximately, BD/AB = $x/l = \theta$, and $e/x = \theta = x/l$; $\therefore x^2 = e\,l$. Let l = 2,000 in., x = 10 in., then e = 0·05 in., equivalent to a decrease of the span by this amount.

It will be seen that the design of a straight line resolves itself into a simple matter as regards the wires and poles. The special work required at angles and road and railway crossings, will, however, considerably add to the designer's duties. In such cases as road crossings safety and security are of paramount importance, and there are many types of cradles and supports in use; the type of road crossing adopted by the writer is a catenary suspension (fig 5); cradles are unsatisfactory and unsightly, and this suspension appears to possess advantages.

The types of railway crossing approved by one of the principal railway companies is given as an example of sound but simple construction (fig. 6).

Terminal arrangements for voltages up to 10,000 may be quite simple; there is no need for the elaboration seen in designs for higher pressures.

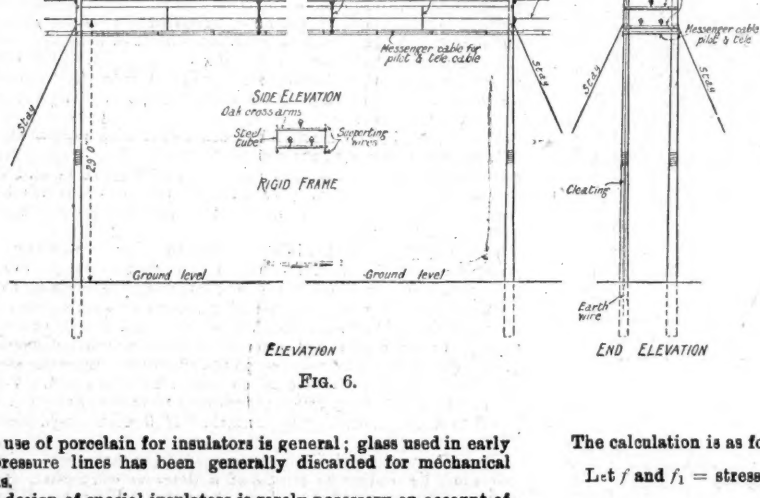


FIG. 6.

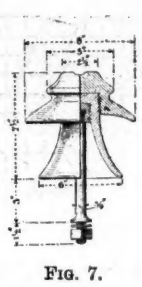


FIG. 7.

The use of porcelain for insulators is general; glass used in early high-pressure lines has been generally discarded for mechanical reasons.

The design of special insulators is rarely necessary on account of the number and excellence of the standard designs which may be bought. Should it be found necessary to design special insulators there is an important rule to be observed that the thickness of the clay should be kept as even as possible.

Large insulators are built up in sections cemented together. Fig. 7 shows the type adopted by the Yorkshire Electric Power Co. for 10,000 volts.

The choice between a bracket and a cross-arm depends on the spacing and relative position of the wires. A symmetrical spacing is, of course, the best, but for moderate distances this is not of so much importance as the distance between wires; the minimum distance is determined by the possibility of short circuits due to birds or the swaying of the wires. Some tests made by the writer to determine the amount of the latter showed that a No. 0000 wire spanning 50 yards with a 3 ft. 6 in. sag swung 3·5 in. each way during a severe gale; a No. 8 wire of the same span and a sag of 1 ft. 10 in. swung 3 in. each way. Birds are more likely to cause trouble at the poles than between wires.

The total cost of an overhead line may be divided into four parts: Cost of wires, supports, labour and wayleaves capitalised.

The cost of wires per mile is decided entirely by electrical considerations and, with a portion of the labour costs, is independent of the number of supports. The cost of supports per mile varies with the number, some items being increased in cost with an increased span, and some decreasing.

If the number of supports per mile is decreased, the poles must be stronger to meet the extra weight and wind load, they must be longer to maintain the same head-room against the increased sag of the wires, and the foundations must be made more secure. The brackets, arms, insulators, stays, &c., must be stronger and the labour of erection per pole is increased. Against these increases per pole, however, we must set the decreased number of supports, and therefore for any particular line there is a most economical span to be found.

It is not possible to generalise as the cost of the items varies considerably for different electrical requirements. It may be noted, however, that the strength of the poles, allowing for increased height with increased span, is approximately proportional to the fourth power of the butt diameter (D^4), and that the cost of wooden poles of lengths between 30 and 60 ft. is proportional to D^3.

Thus if the span is doubled, the cost of poles per mile of line will be increased in the ratio of 1·67 to 1.

The number of poles being decreased, the total labour cost is decreased also; but, as each foundation will prove more costly, not to the same extent.

The decrease in the number of poles will also decrease the wayleaves, and taking all the items into consideration a balance may be struck. In practice one finds that over a considerable range of span variation the cost is fairly constant, and the actual span length is decided by local conditions such as the position of hedges, boundaries, roads, &c. Using single poles under the present Board of Trade rules, a span exceeding 100 yards is not economical. The limiting conditions may be found in the same way for any other type of support—A poles, H, or steel towers.

APPENDIX I.—Testing the Elasticity of Wires.

Two wires of the size and material under observation are stretched between three supporting points in a straight line, spaced so as to form two equal spans. The wires are adjusted to have equal sags as measured as points midway between supports, and are then firmly fixed at one end and clamped together at the other, the clamp being connected to an adjusting screw, by means of which the sag of the wires may be adjusted to any convenient amount. One wire is then lifted from the intermediate support and allowed to hang freely. If the supports have moved due to the change of tension the sag of the other wire will be altered. Adjust, if necessary, the sag of this wire to its original value and measure the sag of the wire having the long span. Then from the observed sags the stress corresponding may be calculated, and also the elongation due to the difference of stress.

The calculation is as follows:—

Let f and f_1 = stresses corresponding to sags s and s_1; then

$$f = \rho\, l^2/8\,s, f_1 = \rho\,(2\,l)^2/8\,s_1,$$
$$\text{and } f_1 - f = (\rho\, l^2/8)\,(4/s_1 - 1/s).$$

Let L = length of wire on span l; e = elastic elongation of length L, due to an increase of stress, in inches. Then—

$$\text{L} - l = 8\,s^2/3\,l \text{ and } 2\,(\text{L} - l) + 2\,e = 8\,s_1^2/3 + 2\,l$$
$$\therefore e = (2\,s_1^2 - 8\,s^2)/3\,l = 2/3\,l\,.\,(s_1^2 - 4\,s^2).$$

Note that if the wire were inelastic e would be zero and $s_1 = 2\,s$, and therefore the stress on the double span also doubled. As an example the results of a test on a No. 6 wire are given below:—

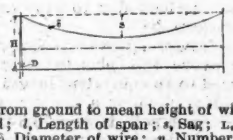
Test of Elasticity of No. 6 H.D. Copper Wire.

Ultimate strength, 61,000 *lb. per square inch. Span*, 1,320 *in.*

Initial sag, s.	Final sag, s_1.	Difference of stress.	Elongation per single span.
Inches.	Inches.	Lb. per sq. in.	Inches.
5	18·0	1,558	0·110
9	26 0	2,780	0·177
12	31·5	3,050	0 210
17	40·0	2,887	0 184

The average elongation for a stress of 40,000 lb. per square inch from the above is 0·2 per cent.

APPENDIX II.—Notation Used.



H, Height of pole from ground to mean height of wires; D, Diameter of pole at ground; l, Length of span; s, Sag; L, Length of wire for a span of l; δ, Diameter of wire; n, Number of wires; a, Cross-sectional area of wire; ρ, Specific gravity of material of wire; F, Stress in lb. per sq. in.; W, Weight in lb. All lengths are in inches.

FIG. 8.

Equitable Charges for Tramway Supply.

(Discussion on paper by Mr. H. E. Yerbury, *at the* Institution of Electrical Engineers, Birmingham Section, *February 16th*, 1910. *For abstract of paper see* Elec. Rev., *p.* 193.)

Mr. R. A. Chattock said that the prices in the 65 towns referred to were fixed by committees of hardheaded business men, and it was inconceivable that in every one of those towns the city engineer should have been able to persuade them to charge the tramways department more than their fair share. Moreover, these prices had to be agreed to by another committee of equally hardheaded business men who watched over the tramways. Mr. Yerbury had stated that the load factor of a tramway supply was better than that of a power supply; this, however, was not so, the figures in Birmingham for the present year being: Lighting, 10·75 per cent.; power, 34 per cent.; tramways, 27·5 per cent. In addition to this consideration, they must remember that large power consumers were generally supplied with high-tension current at 5,000 or 10,000 volts, while the tramways were supplied at a pressure of 550 volts, which necessitated the use of much heavier and more costly cables. He thought Mr. Yerbury's figure of 0·241d. per unit generated, given as the interest and sinking-fund allowance, was too low. He had worked out the Birmingham figure as 0·378d., and he thought Mr. Yerbury must have omitted something, possibly the cost of the feeder cable. The comparative table at the end of the paper was unfair. The cost in the separate stations did not include depreciation or the interest and sinking fund on the cable, while in the case of the combined station, everything was comprised in addition to a certain amount of profit, which, he thought, ought to be at least 5 per cent., in order to allow reserve funds to be set aside. It was a pity that Mr. Yerbury had not made it clear that he was comparing the generating cost of tramway stations with the selling price of combined systems.

Mr. A. M. Taylor thought that Mr. Pearce's charges were substantially correct. The rate per unit which a consumer was charged should include only that element of cost proportional to the number of units sold. All other charges should be thrown into one proportional to the total kilowatts demanded. He exhibited curves to show that in large stations at least the oil, wages and repairs were in no sort of proportion to the units sold nor even to the kilowatts demanded, but were more nearly a constant quantity. In the figures the line A B represented the law of growth if they had been proportional to the kilowatts demanded and C D if proportional to the units generated, whereas the actual state of affairs was given by E F. It would be seen how entirely wrong it was to consider these as a charge proportional to the number of units sold.

Mr. Jackson said that the figure mentioned by Mr. Yerbury as being the profit that should be added before the charge was made to the tramway department was from 3 to 5 per cent. on the running costs only. Mr. Chattock had suggested 5 per cent. on the total costs, but why should it not be something higher? It seemed to him that 5 per cent. on the running costs was not really sufficient for the profitable working of the electricity department. He expressed his appreciation of the point brought out by Mr. Taylor, and he quite agreed that the standing charges ought to be separated in the way that Mr. Taylor had indicated.

Mr. Yerbury, in reply to Mr. Chattock, said that committees always carried into effect what their expert advised. It was certainly a fact that they found considerable difference in the prices charged for tramways supply in separate and combined stations. With respect to power being sometimes sold below cost price, he had seen the statement of accounts of a certain corporation where the total works cost, excluding interest and sinking fund, was ·66d. per unit. This corporation sold energy to power consumers at a penny per unit, with a discount of 40 per cent., reducing the charge to ·6d. per unit. How could they do that without loss? With respect to the interest and sinking fund mentioned by Mr. Chattock, in Sheffield the original loans were for 30 years, but lately they had been for 25 years, so that over the period the charge worked out at 3·163 per cent. There was no doubt that it was very largely due to the very high sinking-fund charges that high prices were charged to the tramways departments. At Manchester they pooled their total charges and also the portion debited to the tramways department. Their service charges were anything from £30,000 to £40,000, and there was the interest and sinking fund to be charged on this, which was certainly not applicable to the tramways department. In reference to the percentage of profit which Mr. Chattock had criticised, they must remember that in municipal undertakings interest and sinking fund had to be allowed for, which in the case of a company would be declared as dividend. Both at Bradford and Manchester they considered that 3 per cent. was an equitable figure. In reply to Mr. Taylor, he admitted that a certain quantity of coal was a fixed charge on the station, but he failed to see how they could differentiate between the quantity burnt to cover losses by radiation and so on, and say how much should be debited to the tramway department and how much to the power consumers. Tramway managers were now working to a standard form of account, in which coal, oil, waste, water and so on were all included as running charges. It had never been suggested that wages were in proportion to units generated. Mr. Jackson had also criticised the figure of 3 per cent. to 5 per cent. profit on the works cost only, but they must remember that they improved the position of the lighting department by the acquisition of the tramway load, so that he thought the figure should be ample. Accidents and contingencies were generally covered by insurance.

The Influence of Various Cooling Media upon the Rise in Temperature of Soft Iron Stampings.

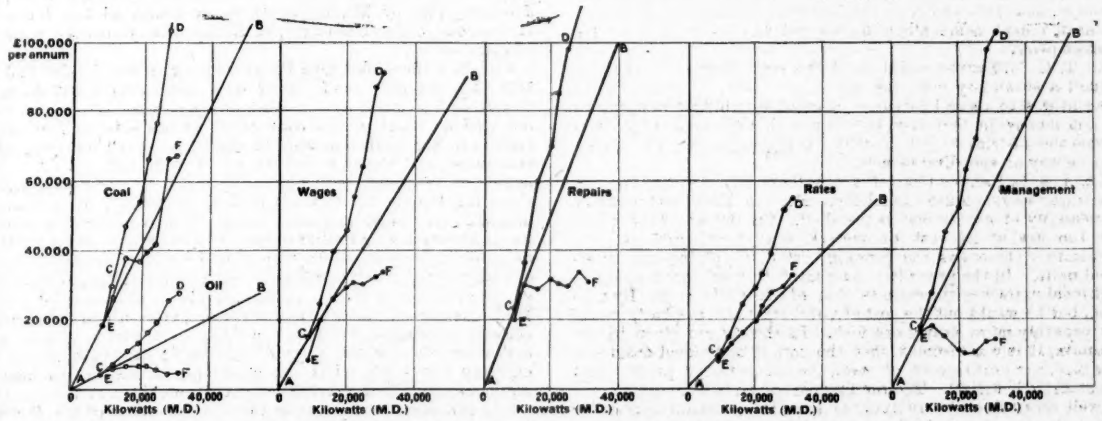
(Discussion on paper by Mr. R. D. Gifford, M.Sc., *at the* Institution of Electrical Engineers, Birmingham Section, *February 16th*, 1910. *For abstract of paper see* Elec. Rev., *p.* 90.)

The chairman (Mr. R. K. Morcom), in opening the discussion, said that he had been investigating designs of bearings for high speeds, trying the effect of water, oil and air blast cooling, and dealing with other similar problems. Having compared his own conclusions with tables given in the paper, he found they agreed very closely.

Dr. Garrard said that cooling effects were greatly increased by providing openings in the windings through which air could pass, and by increasing the speed of the air passing through these ducts. It was surprising how very few data there were on this subject.

Dr. Kapp complimented Mr. Gifford on an exceedingly careful and painstaking piece of scientific investigation. There was another method of cooling not generally known, and which only came to his knowledge recently. With all water worms there was a danger of the pipe scaling or getting furred by sediment if dirty water had to be used. The new method used an oil worm external to the transformer; it was connected to the top and bottom of the transformer case, but was placed in any convenient position where there was running water. A suitably-placed pump was provided which secured a vigorous circulation of the oil. The system had the advantage that it was of no importance whether the water was clean or dirty.

Mr. R. D. Gifford briefly replied to the discussion.



A B, Charges proportional to kilowatts; C D, Charges proportional to units; E F, Actual charges.

Manchester Published Results, 1901—9.

The Present Aspect of Electric Lighting.

(Discussion on paper by Messrs. Handcock & Dykes *at the* Institution of Electrical Engineers. Manchester Section, *February 22nd*, 1910.)

Mr. C. C. Aitchison said that the authors seemed to think the wire lamp had done them harm, but he did not think so, as during the last four or five years the standard of lighting had got higher; the metallic lamp gave the consumer more light for his money, and he did not necessarily think about cutting down his bill. Owners

of shops seemed to think that good lighting and plenty of it was an advertisement. Regarding the statement of the consumption of the 12-c.p. lamp as 15·6 units per annum, he found that for private house lighting it averaged 7·6 units per 8 c.p., which pointed to the fact that they were dealing with large houses installing a number of lamps, the result agreeing with the statement in the paper that a poor return was got from large houses as against small houses. The cost of wiring was somewhat difficult to deal with; the contractor put in as many lamps as possible, with the result that in many cases more lights were installed than were necessary, and they were also badly arranged. This could be rectified if the consumer would only seek the advice of the supply undertaking.

Mr. R. B. Slacke spoke of the cost of depreciation of the metal-filament lamp, which, he understood, was about 1d. per unit; this materially increased the cost of lighting, and he thought in many cases that, instead of renewing the lamp—costing, say, 3s.—the small consumer would get a new mantle and go back to gas.

Mr. P. P. Wheelwright said that, regarding cottage and small property lighting, whatever the system of charging, trouble would sooner or later occur due to the failure or breakage of the lamps. The tenant would then say that he could not afford to replace the broken lamps, as they cost him shillings, whereas gas-mantles could be obtained for a few pence. The suggestion that subsidiary companies should be formed in various districts to sell light on special terms direct to either landlords or tenants was excellent. He did not think that the dusk-to-dawn supply would ever be agreed to for lighting in any district. When his Corporation offered a flat rate for lighting as an alternative to the maximum demand, all but 40 consumers out of 1,200 desired to change to the flat rate, this result being due to their having the satisfaction of understanding how they were being charged.

Mr. J. Frith said he found that, having 32 lamps installed averaging 36½ watts, the consumption was 400 units a year. It worked out that he burnt each lamp 350 hours per annum, and the cost per lamp was 3s. 9d. per year, which was equivalent to 3s. 2d. for a 30-watt lamp. He would certainly object to a charge of 12s. per annum for a 30-watt lamp.

Mr. A. G. Cooper said that in some cases he had got the builder to put electric light in, and in that case the cable was laid into the first house and run right through the cellars, cut-outs being put in every house.

Mr. C. L. E. Stewart said the authors spoke about water supply being similar to electricity, but he did not think so, as a tap continually running was a nuisance. With regard to the cottage houses, their yearly gas bills did not amount to 10s., and he did not think they were worth while connecting-up for electric light, because of the cost of the service. Free wiring did bring on the consumer, but it also brought the bad consumer with it, and when the next tenant came along he wanted the light in a totally different place.

Mr. T. H. M. Swinburne thought the suggestion as to working through a subsidiary company was a good one. The wiring of premises was to a small consumer a great stumbling block, and to lay out money in that way, together with the necessary staff to canvass the district to get the whole thing organised, was a very sensible way of spending money.

Mr. A. S. L. Barnes thought the authors put the case for the "contract" system much too mildly. Far too much was made of the necessity of having meters installed. On the one hand there was the saving in cost of meters, repairs and salaries, and against this there was the running cost of supplying some additional units. In the paper it was assumed that the running cost of additional units was the same as that of the units originally supplied, but he would put the cost at not more than one-half, and it was probably more nearly one-fifth. In the figures given in the appendix, if it was assumed that the cost of additional units was only ·22d. per unit instead of ·44d., the net increased profit would be not £159, but £569. The running cost of additional units could be well ascertained by subtracting the average running cost per unit in the second and third quarters of the year from the average running cost in the first and fourth quarters. Many central station engineers made a great deal too much of the loss of a few additional units. Many members did not realise what a large proportion of the total coal used in a station was for merely being ready to supply. Some time ago he had an opportunity of ascertaining this in Gibraltar, as on several occasions for a whole day shift the supply was shut off, though the steam pressure was kept up. The amount of coal used under those conditions, when worked out for the whole day, came to 25 per cent. of the total coal used in the day. People liked to know what they were going to pay, and many consumers would even pay a little more, as a fixed charge, rather than be troubled with varying amounts registered by meter, and with questions of meters running fast or slow. In Gibraltar, after the advent of metallic-filament lamps, they began to charge a fixed rate per lamp, but on a reducing scale, somewhat on the lines of the charges referred to in the paper. The maximum number of lamps supplied on this system was five, as it was only intended to apply to small flats and shops. A large influx of new consumers resulted, and several old ones, who had meters, requested to be charged on this system, although in some instances it meant their paying more, but they were quite contented, as they knew exactly what they would be called upon to pay, without any question or dispute arising on either side. They took the risk of those people using their lights unnecessarily, but although an inspector was sent out frequently to try and catch people doing so, no instance worth taking any notice of was ever reported. He was convinced of the truth of the statement that "An electric light company can deal with the consumer on this (the fixed charge per lamp) basis, and make a profit out of it."

The Chairman (Mr. S. J. Watson) said he thought the only satisfactory method was that of charging consumers on the rateable value of the property plus 1d. or 1½d. per unit. He believed they had almost passed through the stage when the metallic-filament lamp was affecting the income, and although it had caused in some cases a decline in the units sold for lighting, they were again increasing gradually. It was no part of the duty of supply undertakings to carry out installation work, and particularly to install free wiring. A 24-hours' supply was essential.

Mr H. W. Handcock, in reply, said the standard of lighting had certainly increased very rapidly. He knew of companies which had statutory powers to run along the front of any building. The cost of depreciation of metal-filament lamps really seemed high because the units were very small. In the ordinary street lighting by gas the cost of renewals in mantles, &c., worked out at practically the same figure as for metal-filament lamps. The system of putting in special lampholders had worked very well in Germany and Italy. An efficient transformer could now be got for a remarkably small cost. The Board of Trade had made provision in their regulations for dusk-to-dawn supplies. He had seen the 200-volt 10-c.p. lamp in use about six months ago. The contract system was not intended to apply to present-day electric lighting consumers, but to tap the field gas now occupied. He admitted that the system was not an ideal one. He agreed with the chairman as to charging on the rateable-value basis.

THE FINANCING OF ELECTRICAL ENTERPRISES IN EUROPE.

A Typical Banking Institution.

The important part played by financial institutions, or trusts as they are sometimes termed, in the development of electrical undertakings on the European Continent, particularly in Germany, Switzerland, Italy, Spain and Russia, has been mentioned in this Journal on several occasions in recent years, and it may now be of interest to give some particulars respecting one of the earliest institutions of this kind, its organisation and the methods whereby it has secured the funds for participating in these enterprises. The subject is discussed at length in the *Elektrotechnische Zeitschrift* of January 27th, by Mr. E. Walch, in reference to the Bank für Elektrische Unternehmunger, of Zurich, with which the author is directly associated.

The Bank für Elektrische Unternehmungen was formed in July, 1895, for the purpose of taking over and carrying out financial transactions in so far as they refer to the preparation, construction, acquisition, working, the conversion, or (the disposal, of undertakings in the branch of applied electricity, particularly lighting, transmission of power, transport and electrochemistry. A further statute of the company conferred upon it power to acquire concessions for the industrial utilisation of electricity, to participate, establish, take over, lease or to finance State, communal or private undertakings having similar objects, and to grant to them advances or loans; to acquire, again dispose of or otherwise utilise shares, obligations and other securities of such undertakings, as well as to advance money on the latters' business claims against third parties. It also authorised the company to acquire, establish and utilise, and convert into value, fixed and portable installations, affairs, rights and concessions which appear serviceable or beneficial for the carrying out of electrical undertakings, as well as to take all measures which seem likely to advance the objects of the company.

The company, in addition to having the support of the Deutsche Bank, the Berlin Handels Gesellschaft and the Swiss Credit Anstalt, also had that of other leading German, Swiss and Italian banks and banking firms. In this way the bank, although its formation is attributed to Mr. E. Rathenau, general director of the Allgemeine Elektrizitäts Gesellschaft, was by no means exclusively to serve for the financing of transactions and undertakings of the latter company, but was to be able to extend the scope of activity to all operations having good prospects, in other countries. The share capital was fixed at £1,200,000, of which £300 000 was paid on formation. The first board of directors consisted of 12 members, with Mr. Abegg-Arter, of the Swiss Credit Anstalt, as chairman, and Mr. Rathenau and Dr. Georg Siemens, of the Deutsche Bank, as vice-chairmen. German interests were also represented by Karl Furstenberg, of the Berlin Handels Gesellschaft; Ludwig Delbruck, of the firm of Delbruck & Cie; Julius Stern, director of the National Bank for Germany; Hugo Landau, of the banking firm of Jacob Landau; and Rudolf Sulzbach, of Gebruder Sulzbach, of Frankfort-on-Main.

The actual business management, particularly the preparation of and reporting on all transactions coming before the board, was entrusted to a committee of five members composed of Abegg-Arter, director Spuhler, of the Swiss Credit Anstalt, E. Rathenau, Dr. G. Siemens and Karl Furstenberg, while the management of the bank from the material side was conferred upon the Swiss Credit Anstalt in return for a fixed remuneration.

At the beginning of its activity, the bank had the opportunity of undertaking large operations by the acquisition of three-fifths of the share capital in each of four electric lighting works and tramways at Genoa, to which the necessary means were also assured by firm credits or silent participation, for construction or reconstruction

and for future electrical working. These initial transactions which absorbed £500,000 within a short period, were followed in the second year by a material extension of the scope of action by the assumption of an interest in a fifth Genoa electricity company, and in similar undertakings at Seville and Barcelona, and in electric tramways at Seville and Bilbao. These were accomplished partly by the acquisition of shares, and partly by the opening of credits, and within two years the amount at issue had increased to £2,000,000. These were succeeded by similar and allied operations in other countries, with the exception of participating in manufacturing firms, and the exclusion of the latter is responsible for the circumstance that the bank did not suffer from the serious difficulties which affected various manufacturing firms during the critical years of 1901 to 1903.

The Business Organisation.

The bank, which at the commencement almost wholly devoted its attention to the financing of new undertakings, decided in 1904 to extend its activity to the provision of funds for existing enterprises and the advance of money on their securities, both eventually in connection with the technical and administrative reorganisation of the working, so as to become a general financing institution for electrical transactions, including sound manufacturing firms under certain circumstances. This expansion rendered it necessary for the business organisation to be enlarged. A special bureau was, therefore, established at Berlin, on the one hand, in order to thoroughly examine the schemes and proposals reaching the bank principally from Germany, and, on the other, to obtain due knowledge of all endeavours in regard to the financing of electrical undertakings or the reorganisation of the same; also to work up such operations and impart any desired information to interested parties. The management of the bureau was vested in Dr. Walter Rathenau, who simultaneously became a member of the board of the bank.

The increasing extension of business led soon afterwards to the appointment of two special managing delegates of the directorate in the persons of Dr. Jul. Frey, of Zurich, and Dr. W. Rathenau, of Berlin, and a new period of great development began under their auspices. At the beginning of 1907, Carl Zander, of the Berlin Elektricitäts Lieferungs Gesellschaft, was appointed a director, and at the end of July, 1909, a further reinforcement of the business management was effected in view of the prospective development of electric traction by the nomination of three vice-directors (two engineers and a financier), namely, D. Gauchat, formerly director of the Usines Hydro-Electriques de Montbovon; Dr. R. Haas, of the railway department of the A.E.G.; and E. Walch, who is at the same time acting-director of the Swiss Credit Anstalt. The first-mentioned vice-director has specially a practical experience in the construction and working of power stations, and the transmission of energy, whilst the second engineer is for electric tramway and railway working, and the bank has consequently kept step in its organisation with the growing importance of the electrical industry, and is fully equipped for dealing with it.

The annual report of the financial institution for the year ended June 30th, 1909, contained a table giving a list of the bank's share investments in 25 different undertakings in Germany, Italy, Switzerland, Spain and Russia, amounting to £2,616,000. In addition to these, the advances made to nine undertakings on current account reached £348,360, and five syndicate participations comprised £85,400, the three classes of investments, according to the bank's statutes, thus totalling £3,049,760. The participations relate to the syndicate for the financing of electrical enterprises in Russia (Baku power and Moscow tramways); shares and 4½ per cent. bonds in Gebruder Körting; 5 per cent. debentures of the Victoria Falls and Transvaal Power Co.; the Study Company for Electrical Undertakings in South-West Africa; and shares in the Bavarian Nitrogen Works Co., of Munich. A participation effected since the report was issued concerns the Société Centrale pour l'Industrie Electrique, which was recently formed in Paris, and in which the bank, in conjunction with the Berlin Electrical Enterprise Co. (Gesellschaft fur Elektrische Unternehmungen) and the Belgian Société Financière de Transports et Entreprises Industrielles, of Brussels, took over a considerable portion of the shares subscribed for by the Comptoir National d'Escompte, the Société Générale pour Favoriser l'Industrie, the Banque de Paris, the Union Parisienne, &c. The formation of the Société Centrale provides for France an institution similar to the three trust banks just mentioned. The Zurich bank exercises control over the course of business of the various undertakings in the case of small investments by requisitioning regular working returns periodically, whilst the same object is achieved in regard to larger interests by appropriate representation on the boards of the different companies.

The Flotation of Capital.

If consideration is now given to the question as to how the institution raised the necessary capital, it has to be remembered that on the formation of the company, the share capital was so calculated as to be able to meet the expected development for a long time to come. But immediately after its constitution, larger transactions appeared on the scene, and the one-fourth of the capital of £1,200,000 paid up at the beginning was followed by a further call of one-fourth a few months later, whilst the remaining half was paid in January, 1898. On this occasion the opportunity was also afforded to the shareholders in the bank to exchange one £200 nominal share for one £80 nominal share in the A.E.G. in connection with the taking over by the Deutsche Bank on behalf of a financial syndicate, of £600,000 in new shares of the A.E.G., and as a large number of shareholders accepted the offer, the A.E.G. succeeded in substantially increasing its interest in the bank, and the company has remained a large holder of the shares. When the whole of the shares in the Bitterfeld Elektrochemische Werke were acquired by the bank from the A.E.G. in December, 1900, the purchase price was partly settled by an augmentation in the share capital of the bank by £120,000 nominal, and the not inconsiderable premium thereby realised was transferred to the reserve fund. At the beginning of 1905 the A.E.G. again took over a new issue of the bank's shares of a further nominal sum of £120,000 at the rate of 145 per cent., and as payment on account for the transfer of the Solingen tramways, and in this case also the amount of the premium was placed to the reserve fund. Finally, the special meeting held in May, 1907, authorised the raising of the bank's capital from £1,440,000 to £1,600,000, and the shareholders fully subscribed the issue at the price of 148 per cent. A portion of the resulting premium was devoted to increasing the ordinary reserve fund to the statutory amount of 10 per cent. of the share capital, whilst the balance was allocated to a special reserve fund. The shares are quoted on the Stock Exchanges of Zurich, Basle, Geneva, Berlin and Frankfort-on-Main, and stand at about 200 per cent. on the basis of the dividend of 10 per cent. for 1908-9.

The statutes of the bank empower it to issue bearer bonds to the amount of twice the paid-up share capital. Advantage of this power was taken in the first year of the existence of the institution by the emission of the 4 per cent. "A" obligation loan of £1,200,000 in £40 bonds, which were successively disposed of to a banking syndicate at par, and which are to be redeemed by annual drawings at the price of 103 per cent. between 1901 and 1935. In order to increase the working funds a further obligation, or "B" loan, of £320,000 was issued in October, 1900, the rate of interest being 4½ per cent., as the then monetary conditions were not favourable for 4 per cents. This loan is also redeemable by annual drawings at a premium of 3 per cent. between 1907 and 1935, in so far as the whole or a part of it is not repaid previously by the bank giving three months' notice from January 1st, 1907. A third debt of £200,000, also in 4½ per cent., or "C" bonds, was finally raised in October, 1907. This is not redeemable by yearly drawings, but is repayable on January 1st, 1918, at par. After allowing for redemption already effected, the total loan debts of the bank now amount to £1,520,000 with a paid-up share capital of £1,600,000 and reserves reaching £180,000. The bonds are also dealt in on various exchanges, and are all quoted above par value.

It may be estimated that the funds raised by the bank in shares and obligations, and in premiums and profit surpluses devoted to reserve funds amount to £4,400,000, but this does not represent the whole of the capital which the institution has diverted to electrical undertakings. Thanks to its banking connections, the bank has been able to place means at the disposal of one or other of the companies patronised by it, by the placing of their shares and obligations, and in this way the institution has also indirectly exercised a fruitful influence on the revival of transactions in the electrical industry, and, at the same time, awakened the interest of additional capitalistic circles in this industry.

The Financial Results.

During the early years of its existence the dividends paid by the bank were naturally only of moderate amount, as the undertakings financed by it were, at the time, either still in course of establishment or at the preliminary stage of working. In the second and third years the distribution was 5 per cent. in each case and 6 per cent. in the fourth year. In 1904-5, the rate was 8½ per cent., and this rose to 9 per cent. in 1905-6, 9½ per cent. in 1906-7, and 10 per cent. in 1907-8, the dividend for 1908-9 being also at the rate of 10 per cent. The report for the latter year mentions that the share investments have been written down to the nominal value, but the securities in which the bank is mostly interested stand at premiums ranging from 140 to 210 per cent. It stated that the profits realised from the sale of shares are only drawn upon to a slight extent for the distribution of dividends, and this leads to the assumption that the latter will not be exposed to heavy downward fluctuations also in the future. The bank directs special attention to being equipped for fresh transactions, as is shown in the last report by the bank credit and easily realisable securities amounting to £700,000; and it is considered that the promoters of the institution can look back with justified satisfaction at their creation and the appropriate material results which it has yielded.

Electro-metallurgy in Mexico.—A company has been formed under the laws of the Republic of Mexico for the purpose of manufacturing different varieties of steel, calcium carbide, and certain other products. The Héroult type of electric furnace will be used for the production of tool and drill steel, shoes and dies, forgings and steel castings, and light steel rails weighing from 14 to 20 lb. The furnace will have a capacity of 16 to 20 tons of ingot steel per day. The company has also ordered, and is now constructing, a plant for the manufacture of calcium carbide at the City of Mexico, using a continuous type of furnace. The plant will have a capacity of from 3,000 to 5,000 tons of carbide per year, which will be sold in the Republic for the purpose of acetylene lighting. Both the above furnaces will be of the single-phase type. The company has purchased a tract of land of about 30 acres within the city limits of Mexico, where the work of construction is now going on. Later on it is expected that certain chemicals will be manufactured in a large way.—*E.M.I.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW ZEALAND.—Preferential rates are granted to certain British goods imported into New Zealand, and in order to secure these rates, goods should be accompanied by a certificate of origin. This certificate, which must be in one of the following forms, must be written, printed or stamped on the back of the invoice:—

Form of certificate prescribed to be written or printed on invoices of all articles, except tea, for entry under the Preferential Tariff of New Zealand, when made and signed by an individual exporter personally.

I, [full name of exporter], the exporter of the articles included in this invoice, have the means of knowing, and do hereby certify that the said invoice, being from myself to [name of party or parties to whom articles invoiced], and amounting to [insert in words at length total value of invoice], is true and correct; that all the articles included in the said invoice are *bona fide* the produce or manufacture of one or more of the following countries, viz., [names of countries being in every case parts of the British dominions]; and that a substantial portion of the labour of one or more of such countries has entered into the production of every manufactured article included in the said invoice, to the extent in each article of not less than one-fourth of the value of every such article in its present condition, ready for export to New Zealand.

(Signed)

Dated at , this day of , 19 .

Form of certificate prescribed to be written or printed on invoices of all articles, except tea, for entry under the Preferential Tariff of New Zealand, when made and signed by a person other than an individual exporter.

I, [full name of person signing certificate], hereby certify that I am [insert the words "partner," "manager," "chief clerk," or "principal official," giving rank as the case may be] of [name and address of exporter or exporters], the exporter(s) of the articles included in this invoice, and that I am duly authorised to make and sign this certificate on behalf of the said exporter(s).

I have the means of knowing, and I do hereby certify, that this invoice from the said [name of exporter or exporters] to [name of party or parties to whom articles invoiced], amounting to [insert in words at length total value of invoice], is true and correct; that all the articles included in the said invoice are *bona fide* the produce or manufacture of one or more of the following countries, viz., [names of countries being in every case part of the British dominions]; and that a substantial portion of the labour of one or more of such countries has entered into the production of every manufactured article included in the said invoice to the extent in each article of not less than one-fourth of the value of every such article in its present condition, ready for export to New Zealand.

(Signed)

Dated at , this day of , 19 .

The value of goods for calculation of *ad valorem* duty is their fair market value, when sold for home consumption in the principal markets of the country whence, and at the time when, the goods were exported, including the value of the cask, case, or other covering, with 10 per cent. added. The value is in no case to be the cash value, nor shall any discount for cash be allowed, except when the article is universally known to be a cash article. In cases where entry is offered or made of any goods liable to *ad valorem* duty in respect of which goods any agreement or arrangement, whether provisional or complete, is made for the delivery of goods, after clearance at the Customs, to any purchaser in New Zealand, the true value of such goods is the amount paid by the New Zealand purchaser, less a fair allowance for freight, insurance, and duty (if any), with an addition of 10 per cent. after deducting the said allowance.

It should be noted that a surtax of 2½ per cent. of the amount of duty leviable at the various rates has recently been imposed on all goods imported into New Zealand.

(To be continued.)

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

4,226. "Improvements in electrolysis." J. T. Irwin and J. W. Stubbs. February 21st.

4,230. "Improvements in electric contacts for operating signal and other apparatus on electric tramways or railways." R. G. Cunliffe, J. G. Cunliffe and E. Dewhurst. February 21st.

4,251. "Improved means for fixing telegraph, telephone and like wires to insulators." A. Hinds and E. F. James. February 21st.

4,257. "Improvements in resetting devices for the trolleys of electric car systems and the like." H. Waine. February 21st.

4,263. "Improvements in or relating to dynamo-electric machines for voltage transformation." Siemens Bros. Dynamo Works, Ltd., and W. Parker. February 21st.

4,268. "Improvements in and relating to the regulation of electric frequency transformers." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) February 21st. (Complete.)

4,273. "Improvements in or relating to electric meters." A. Stromberg and G. M. Willis. February 21st. (Complete.)

4,299. "Improved twin electric lampholder." J. H. Cunnington. February 21st.

4,309. "Improvements in and relating to means for supplying power to electrically-propelled vehicles." C. V. Drysdale. February 21st.

4,318. "Improvements in and relating to circuit closers." H. C. Thomson. February 21st. (Complete.)

4,320. "Improvements in electrical accumulators." F. W. Hardy and E. H. Hungerbuhler. February 21st.

4,356. "Electric vermin catcher." H. V. James. February 22nd.

4,359. "Improvements in electric writing or stamping machines." L. Pratschker. February 22nd. (Complete.)

4,386. "Improvements in electric cut-outs." J. S. Smith. February 22nd.

4,398. "Improvements in the manufacture of separators for electrical batteries and electrolysis apparatus." P. Marino. February 22nd.

4,425. "Improvements in electric lamp shade or reflector attachments." H. d'Olier, jun. February 22nd. (Complete.)

4,446. "Improvements in telephone transmitters." F. Gottschalk. February 22nd. (Complete.)

4,449. "Improved combined electric and percussion primer for the cartridges of ordnance." G. Roth. (Akt. Ges.) (Date applied for under Sec. 91 of the Act, March 11th, 1909, being date of application in Austria.) February 22nd. (Complete.)

4,452. "New or improved method and means for removing or rendering innoxious foreign matter or impurities contained in certain materials or substances by means of electricity." D. L. V. Browne. February 22nd.

4,453. "Improvements in or relating to the softening and purification of water by means of electricity and apparatus therefor." D. L. V. Browne. February 22nd.

4,463. "Improvements in arrangements for charging or discharging accumulators or secondary batteries." A. M. Taylor. February 23rd.

4,467. "Improvements in and appertaining to electrical lamps and other goods having leading-in wires sealed through them." B. E. Eldred. February 23rd. (Complete.)

4,531. "Improvements in relay apparatus particularly intended for use in connection with telephonic and telegraphic systems." S. G. Brown. February 23rd.

4,533. "Combined fastenings and electric light controlling devices for doors." W. E. Sidat. February 23rd.

4,535. "Antiseptic telephone mouthpiece." C. L. Lloyd. February 23rd.

4,541. "Improved method of, and apparatus for, giving warning of the approach of a train on railways." Walter's Electrical Manufacturing Co., Ltd., and E. E. Moore. February 23rd.

4,567. "Improvements in, and relating to, the ventilation of electric accumulator cells." A. B. Pescatore and Tudor Accumulator Co., Ltd. February 23rd.

4,599. "Improvements in electrical terminals." R. W. Paul. February 24th.

4,614. "Improvements in means for limiting short circuits in alternating and direct-current circuits." A. M. Taylor. February 24th.

4,645. "Improved method of resuscitating the negative plates of secondary batteries and assisting in their formation." February 24th.

4,648. "Improved trolley head for use on electric tramcars and the like." R. E. Pillard and H. H. Foster. February 24th.

4,650. "Improvements in electric alarms for hotels and the like." M. Lutterkorth. February 24th.

4,669. "Electrical transmission dynamometer." C. V. Drysdale. February 24th.

4,678. "Controlling device especially applicable for use with electrically-operated printing and stamping machines." M. Rockstroh. February 24th. (Complete.)

4,681. "Improvements in or relating to driving mechanism for petrol-electric apparatus." Felten & Guilleaume Lahmeyerwerke A.G. (Application for Patent of Addition to No. 15,282 of 1909. February 24th. (Complete.)

4,696. "Improvement in systems of and apparatus for the control of electric translating devices." A. H. Olmsted. February 24th. (Complete.)

4,697. "Improvements in and relating to the control of electrically-operated switches." H. E. White and E. R. Carichoff. (Date applied for under Sec. 91 of the Act, February 26th, 1909, being date of application in United States." February 24th. (Complete.)

4,713. "Improvements in or applicable to electric lifts and other lifts and like apparatus." D. E. Barnes and A. A. G. Jensen. February 25th.

4,716. "Improvements in insulators as used on the overhead wires of electric tramways and railways and the like." H. H. Dudgeon. February 25th.

4,722. "Improvements in electromotors." W. Smith. February 25th.

4,724. "Commutator cleaning hand-tool, for grinding and cleaning the commutators and slip-rings of electric generators and motors." T. Taylor. February 25th.

4,738. "Device for checking telephone calls." F. R. Eggington. February 25th.

4,744. "Improvements in and relating to starting switches for electric motors." I. Holmes. February 25th. (Complete.)

4,758. "Improvements in and relating to magnet-dynamos for lighting and other purposes." J. de Coster. February 25th. (Complete.)

4,795. "Employment of metals in the electric arc for the sterilisation of liquids." E. Urbain, A. Feige and C. Seal. (Date applied for under Sec. 91 of the Act, January 17th, 1910, being date of application in France.) February 25th. (Complete.)

4,804. "Improved electro-magnetic vibrator for local application to the person." A. Rosenberg. (Application for Patent of Addition to No. 4,133, 1909.) February 25th. (Complete.)

4,811. "Improvements in and relating to the control of electrically-operated switches." H. E. White. (Date applied for under Sec. 91 of the Act, February 27th, 1909, being date of application in United States.) February 25th. (Complete.)

4,858. "Electric meat stamp." J. A. Jordan. February 26th.

4,885. "Improvements in magazine arc lamps." Johnson & Phillips, Ltd., and J. Brockie. February 26th.

4,886. "Improvements in magazine arc lamps." Johnson & Phillips, Ltd., and J. Brockie. February 26th.

4,887. "Imroved method and apparatus for obtaining constant potential in an electric circuit supplied from a generator running at variable speed." W. F. Grafton. February 26th.

4,893. "Improvements relating to the cooling of commutators of dynamo-electric machines." British Thomson-Houston Co., Ltd., and W. F. Dawson. February 26th.

4,906. "Improvements in switches for electrical transformers." S. A. Berners. February 26th.

4,910. "Improvements in wireless telegraph receiving stations." Marconi's Wireless Telegraph Co., Ltd., and C. S. Franklin. February 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Wireless Telegraphy. A. F. H. S. Simpson. 27,743. December 21st.

Distribution of Electric Energy and Cables therefor. A. E. Tanner and E. A. Claremont. 27,859. December 22nd.

Scaling, Annealing and Coating Metals. S. O. Cowper-Coles and Metalloids, Ltd. 28,181. October 30th.

1909.

Alternating-Current Electric Machines of the Commutator Type. Allgemeine Elektricitäts Ges. 1,705. January 23rd. (Date applied for under International Convention, January 24th, 1908.)